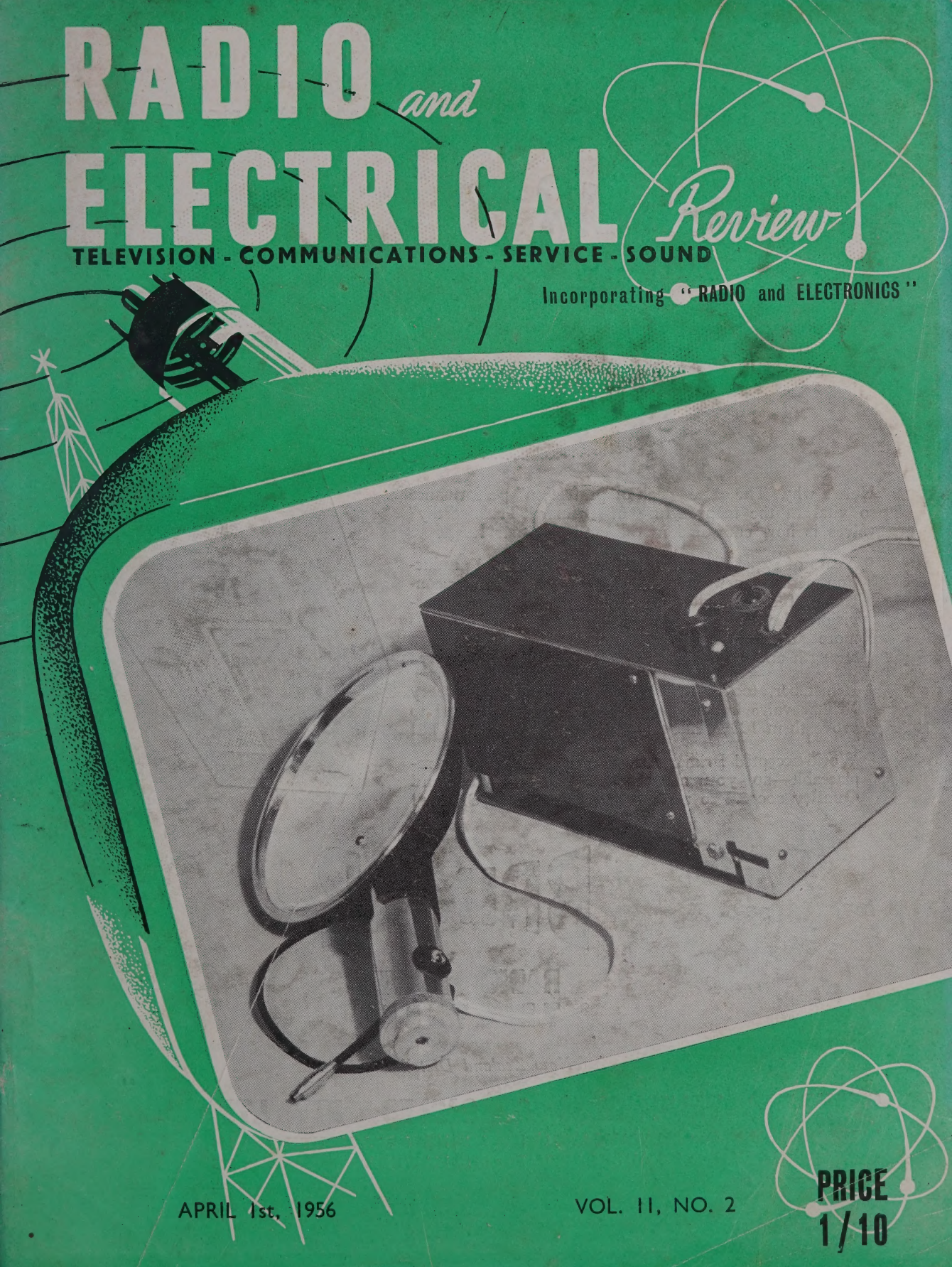
# RADIO and ELECTRICAL Review

TELEVISION - COMMUNICATIONS - SERVICE - SOUND

Incorporating "RADIO and ELECTRONICS"



APRIL 1st, 1956

VOL. 11, NO. 2

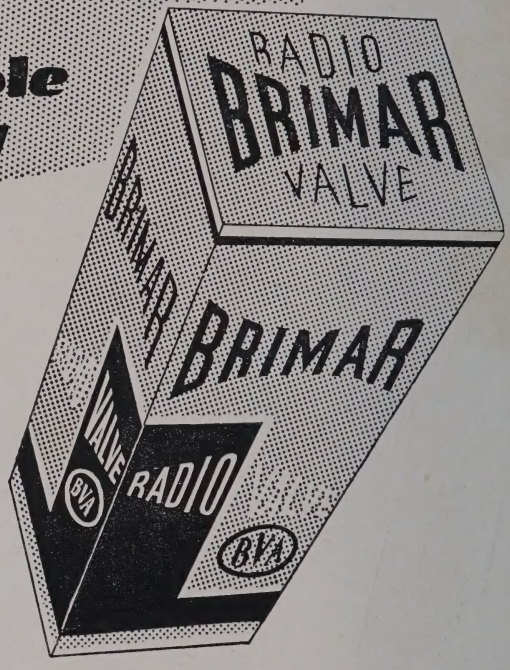
PRICE 1/10

# Quality - worthy of your trust

BRITISH MADE

# BRIMAR VALVES

## Now more reliable than ever!




Here's why: The same "peak of perfection" performance so vital in the manufacture of Brimar "Trustworthy" valves is now embodied in the entire Brimar range.

- Years of experience, new techniques, improved production methods, new and better assembly jigs, tighter control on the composition of materials, and closer supervision of vital processes have resulted in valves with more uniform characteristics, greater mechanical strength and thus **a higher standard of reliability!**
- Remember, too—before they are carton-sealed, every Brimar valve has undergone 10 rigid factory tests to prove them 100% efficient—as good as valves can be!
- World-accepted Brimar American-types are readily replaceable—**so you can be sure of Service and Quality second to none when you choose Brimar!**

# BRIMAR

## RADIO VALVES
## TELETUBES

*New Zealand Distributors:*

**STANDARD TELEPHONES & CABLES PTY. LTD.**

| | | | | | |
|---|---|---|---|---|---|
| WELLINGTON | Box 593 | WANGANUI | Box 293 | NEW PLYMOUTH | Box 344 |
| CHRISTCHURCH | Box 983 | AUCKLAND | Box 571 | HAWERA | Box 283 |

STC

# Radio and Electrical Review

OUR COVER PHOTO this month shows an electronic flash-gun whose design and construction will be described in the May, 1956, issue of this journal. It uses a modern 150-volt flash tube and gives a 30-joule flash. If additional condenser capacity is used, the flash can be made up to the tube's maximum of 100 joules.


Official Journal of
The New Zealand Electronics Institute (Inc.).
The New Zealand Radio and Television Manufacturers' Federation.
The New Zealand Radio and Electrical Traders' Federation.
New Zealand Radio, TV, and Electrical Association (Inc.).

Managing and Technical Director:
W. D. FOSTER, B.Sc.

Advertising Manageress:
Miss D. JAMIESON

Subscriptions:
1s. 10d. per copy; 23s. 6d. per annum, posted.
Advertising Rates supplied on application.

CORRESPONDENCE
All correspondence and contributions should be addressed to:
The Editor,
"Radio and Electrical Review",
P.O. Box 8022,
Wellington, New Zealand.

OFFICES AND LABORATORY:
Radio and Electronics (N.Z.) Ltd.,
46 Mercer Street, Wellington.
Telephone, Wellington, 70-216.
Telegrams and Cables:
"Radel", Wellington.

SOLE ADVERTISING REPRESENTATIVES for THE UNITED KINGDOM:
Cowlishaw and Lawrence (Advertising), Ltd., 28 New Bridge Street, London, E.C.4.
Telephone City 5118.
Cables: Cowlawads Cent, London.



VOL. 11, No. 2 APRIL 1st, 1956

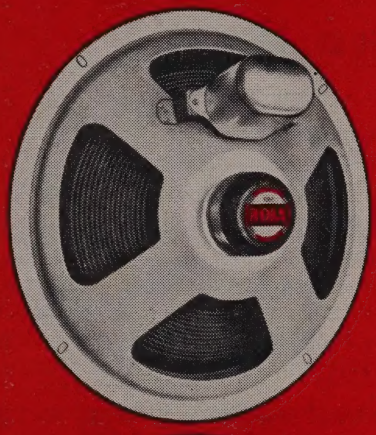

## Contents

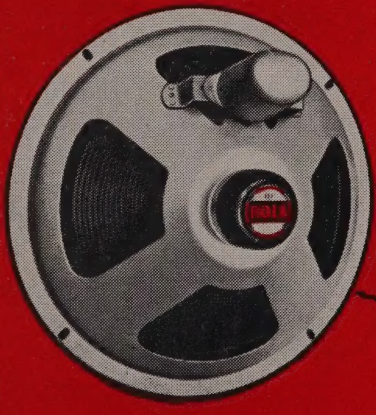

| | Page |
|---|---|
| Editorial | 21 |
| An Inexpensive Three-valve Broadcast Set | 22 |
| Plessey Research Limited | 25 |
| Amateur Transmitting: A Transmitter with Some Unusual Features | 26 |
| Radio Industry to have a "New Look" at Naenae | 28 |
| Circuits for the Experimenter: Crystal Oscillator Circuits | 31 |
| A Unique Auto Radio Installation for the Basrah Petroleum Company | 33 |
| The Philips Experimenter No. 102: A Transistorized Geiger Counter for Prospecting Use | 34 |
| A New High-frequency Point Contact Transistor | 36 |
| Record Talk, by John Gray | 37 |
| Commencement of Electrical and Trade Section | 38 |
| Maintenance of Electric Cookers | 38 |
| Trade Winds | 41 |
| A Practical Television Course through the Technical Correspondence School | 42 |
| Dry Battery Technotes No. 8: Some Points for Amateur Designers | 43 |
| New Products | 44 |
| New Zealand Electronics Institute (Inc.) | 46 |
| N.Z.A.R.T. Notes | 46 |
| For the Technician: Morphy Richards Auto Control Safety Electric Irons—Part 3 | 47 |
| Around and About | 48 |
| Wireless Appartus Import Returns | 48 |
| "Radio New Zealand" Frequencies | 49 |
| Missing and Stolen Radios | 49 |
| Classified Advertisements | 50 |
| More "Around and About" | 52 |



*Sole New Zealand Distributors: Gordon & Gotch (N.Z.) Ltd., Wellington*

PRINTED BY HARRY H. TOMBS, LTD., WINGFIELD STREET, WELLINGTON.




# Now Made in New Zealand

*to the most stringent Australian Specifications*

## A full range of ROLA

## Concert Type 12 inch Loudspeakers

*Full Technical Details from*

LOUDSPEAKERS (N.Z.) LTD. KENT TERRACE WELLINGTON

# TURNBULL and JONES

**announce**

**that they have taken over**
**the Sole New Zealand Agency**
**for**

# GOODMANS

## HIGH FIDELITY LOUDSPEAKERS

**Trade Enquiries Welcomed**

**TURNBULL and JONES LIMITED**

AUCKLAND WELLINGTON CHRISTCHURCH DUNEDIN HAMILTON
PALMERSTON NORTH NELSON AND INVERCARGILL

# HOW BELL HELPS YOU SELL MORE RADIOS

**FREE**
**NEWSPAPER BLOCKS**
available in sizes to suit your advertising requirements

**FREE**
**RADIO COPY**
featuring your name and address

**FREE**
**SCREEN SLIDES**
for all models—supplied complete with your firm's name and address

**FREE**
**SHOWCARDS**
to help you with your own point-of-sale displays

**FREE**
**PRICE TICKETS**
issued with each model as it is released

**ADDITIONAL PULLS**
of all advertisements, supplied in quantity. Suitable for your local mailings or for shop distribution

## WITH NATION-WIDE ADVERTISING

Through metropolitan and provincial newspapers, through the national network of commercial radio, BELL reaches customers in every corner of New Zealand. Four days every week, over 200,000 homes hear BELL announcements. Every month, BELL newspaper advertisements are looked at nearly 1½ million times. The name BELL is no stranger to the customer when he enters your door.

## WITH EXTRA SERVICES TO YOU

Bell's 'Dealer Service' Plan helps you sell more radios and saves you **real** money at the same time. Shown at left are some of the ways you benefit.

**WRITE NOW FOR FREE MATERIAL**

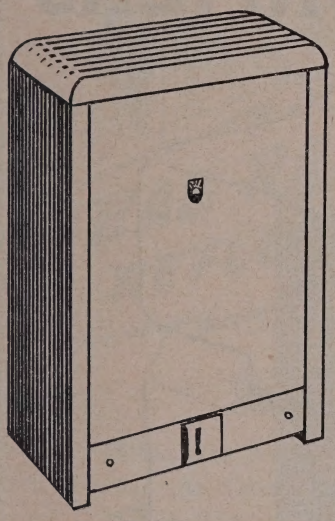
**BELL Radio**

BELL RADIO-TELEVISION CORP. LTD.
274 Dominion Road, Auckland

Sell MORE radios, make MORE satisfied customers—write NOW for your requirements DIRECT to BELL DEALER SERVICE, CASSRELS ADVERTISING LTD., P.O. BOX 2941, AUCKLAND.

# THERMODARE

"OFF-PEAK" ELECTRIC STORAGE HEATER
FOR OFFICES - CHURCHES - FACTORIES



THERMODARE HAS SOLVED
THE HEATING PROBLEM . . .

THERMODARE have specialized in "off-peak" thermal storage unit heating. Years of research have produced a Heater scientifically designed to maintain constant warmth throughout the day from heat stored during the night. This refractory storage medium has particularly high specific heat and specific gravity, which can be subjected to a considerable temperature range.

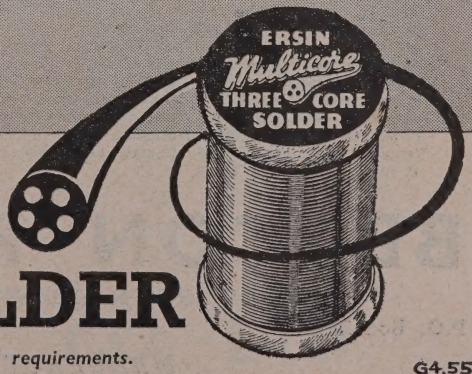
VOLTAGE SUPPLY: 230 Volts, 50 Cycles.

For Further Details Write to New Zealand Representatives:

**A. R. HARRIS COMPANY LIMITED**

72–76 MANCHESTER STREET —— CHRISTCHURCH

# Multicore meets every need for everything that needs core solder...




**ERSIN**

# MULTICORE SOLDER

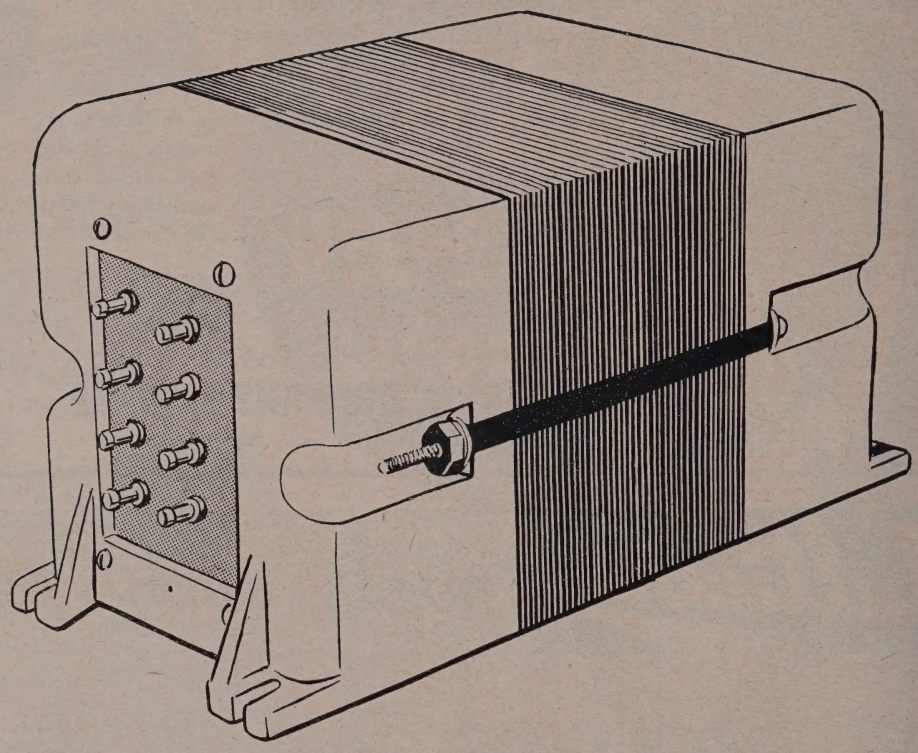
*Available ex-stock in a range of gauges and alloys to meet all requirements.*

G4.55

New Zealand Distributors: GILES & ELLIOTT LTD.
Wellington, Auckland, Christchurch, Dunedin.

Also available from all branches of Turnbull & Jones Ltd.

# ULTRALINEAR
# Output TRANSFORMERS



Considerable interest has recently been taken in the American ultralinear version of the famous Williamson Amplifier. A reduction in distortion and an increase in power output over that of the Williamson Amplifier has been claimed by the originators of the circuit. As in the Williamson Amplifier, a major part is played by the design and construction of the output transformer. BEACON makes a transformer rated at 30 watts which will work well when used in an ultralinear circuit. Screen taps are available so that push-pull KT66 valves, or similar types, may be used as pentodes with a sharing of load between screens and plates. The frequency response over the audio frequency band is excellent. We recommend this transformer for use in amplifiers where greater power output than that obtainable from the normal Williamson Amplifier is required. Cat. No. 53S66, 30-watt ultralinear output transformer, 6,600 ohms P to P to 1-4-9-16 ohms.

PHYSICAL DIMENSIONS

| Width | Length | Height |
|---|---|---|
| 3¾ in. | 7 in. | 4⅝ in. |

| Mounting Centres | Weight |
|---|---|
| 6⅜ in. x 3 in. | 12 lb. |

# BEACON RADIO LIMITED

CORNER BROWN AND FITZROY STREETS, PONSONBY, AUCKLAND

P.O. Box 2757 Telephones: 14-704, 13-390

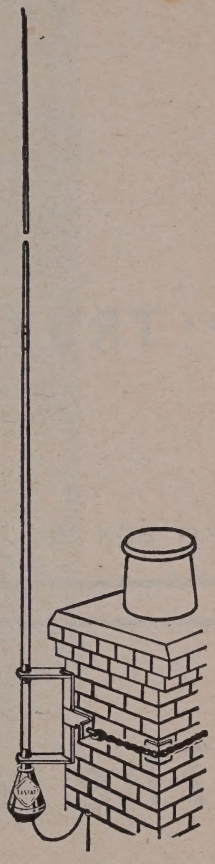
*MANUFACTURERS OF ALL KINDS OF*

TRANSFORMERS AND FLUORESCENT LAMP BALLASTS

*When you sell a radio set, remind your customer that the better the set the greater the need for a first-class anti-interference aerial.*

The "EXSTAT" Aerial is designed to cut out the annoyance of electrical interference and to ensure crystal-clear reception at the receiver.

"EXSTAT" has a proven record of service in town and country, and is an ESSENTIAL FITTING for all showrooms.



Illustrated: TYPE ASA 412 with 4-section, 16 ft. Whip Aerial.

# THE "EXSTAT" AERIAL

| | | | |
|---|---|---|---|
| VRA 301 | Wall Mount Rod | £4 13 4 | Retail |
| VRA 302 | Chimney Mount Rod | £5 13 0 | „ |
| ASA 301 | Horizontal Noise Suppression | £8 12 0 | „ |
| ASA 412 | Chimney Mount Rod with Noise Suppression | £12 17 11 | „ |
| ASA 412N | Wall Mount Rod with Noise Suppression | £12 3 4 | „ |
| ASA 304 | Extra Aerial Transformers | £2 12 0 | „ |
| ASA 305 | Extra Receiver Transformers | £2 12 0 | „ |

Trade Inquiries:

## RUSSELL IMPORT CO. LTD.

20 BOND STREET, WELLINGTON P.O. BOX 102

## THE FINEST TAPE RECORDER IN THE WORLD

# "TRUVOX" of England

*P. H. Manoy, P.O. Box 3689, Auckland,*
*is privileged to announce his appointment*
*as Sole New Zealand Representative for*

## "TRUVOX" TAPE DECK AND ACCESSORIES

*Stocks to be available soon* *Trade inquiries invited*

## P. H. MANOY

P.O. BOX 3689 - AUCKLAND

# The Quickdraw

**Price £5 5s.**
Postage 1s. 9d.

- Assists in rapid production of sketches, line drawings, or electrical wiring diagrams.
- No previous experience required.
- Plastic template with two inserts produces varying angles, triangles, and rectangles, protractor and up to 3-in ellipse.
- Scales in inches and millimetres; diameters of circles from 1/16 to 1 in.
- Size of complete unit, 14 in. sq. Weight 2½ lb.

Inquiries welcomed by New Zealand Distributors:

## HALLAMORE HOUSE LTD.

P.O. BOX 2365 21 EVERTON TERRACE, WELLINGTON

# RCA

## ..."Headquarters" for Phototubes

INDUSTRY PROVED

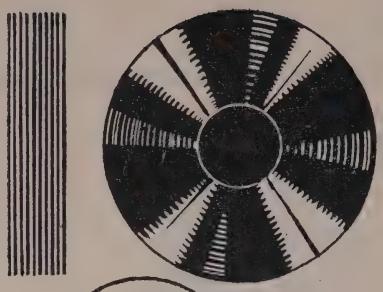
RCA—pre-eminent in the design and development of photo-tubes—offers a comprehensive line of high-quality photo-tubes to meet your replacement needs in light-actuated devices. The line includes a wide selection of gas types (for sound-on-film and relay work), vacuum types (for fast response and precision measurements), and multiplier types (for applications where extremely high sensitivity is important, such as scintillation counting). RCA Photo-tubes are available in a variety of spectral responses, physical shapes, and sizes from your RCA Tube Distributor. For tube technical data on RCA Photo-tubes write to the

NEW ZEALAND REPRESENTATIVES:

**AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED**

P.O. BOX 830 WELLINGTON. P.O. BOX 1363, AUCKLAND. P.O. BOX 2084, CHRISTCHURCH.

# RECORD FEATURES



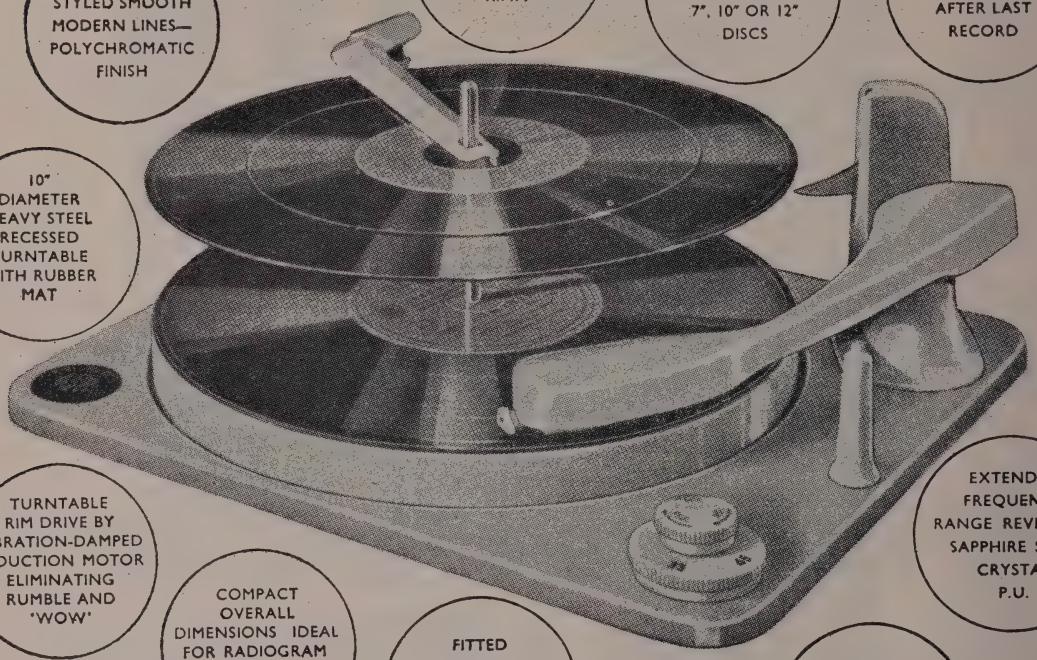
PLAYS 10 MIXED DIAMETER RECORDS AT 33⅓, 45 OR 78 R.P.M

'MAGIDISK' AUTOMATICALLY SELECTS 7", 10" OR 12" DISCS

P.U. RETURNED AND MOTOR SWITCHED OFF AFTER LAST RECORD

BEAUTIFULLY STYLED SMOOTH MODERN LINES— POLYCHROMATIC FINISH

10" DIAMETER HEAVY STEEL RECESSED TURNTABLE WITH RUBBER MAT



TURNTABLE RIM DRIVE BY VIBRATION-DAMPED INDUCTION MOTOR ELIMINATING RUMBLE AND 'WOW'

EXTENDED FREQUENCY RANGE REVERSIBLE SAPPHIRE STYLI CRYSTAL P.U.

COMPACT OVERALL DIMENSIONS IDEAL FOR RADIOGRAM OR T.V. CONSOLE

FITTED ANTI-ACOUSTIC FEED BACK SUSPENSION SPRINGS

SIMPLE UNIT CONTROL 'ON,' 'OFF,' 'REJECT' AND RECORD SPEED

BSR

# MONARCH

## WORLD'S FINEST AND MOST WANTED AUTOCHANGER

*Only the Monarch Autochanger has ALL these features. Its record performance, fidelity reproduction and absolute reliability are acclaimed by music lovers and record enthusiasts everywhere — It's the first choice of the experts.*

**Manufactured by BIRMINGHAM SOUND REPRODUCERS LTD., ENGLAND**

Sole New Zealand Representatives:

## DAVID J. REID (N.Z.) LTD.

P.O. BOX 2630 AUCKLAND

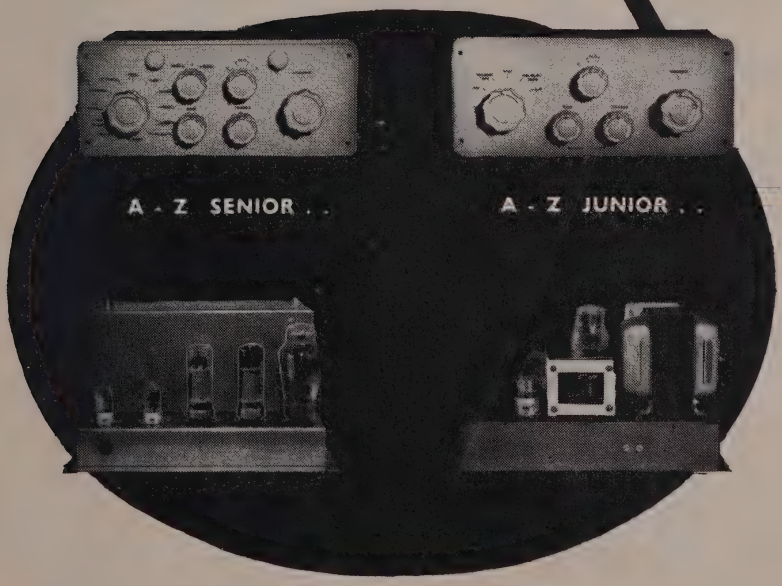
# *A new note in musical Performance . . . .*

**Stop Press!**

TRI-CHANNEL 3-C
REPRODUCER
IS COMING!

# The A-Z Linear Amplifiers

SENSATION OF THE NEW YORK AUDIO FAIR!




THE FIRST SHIPMENT IS HERE! The Amplifier you'll be proud to offer the most critical and fastidious enthusiast!

A–Z JUNIOR 10 WATT
The Ultra Linear Mark II. Peak output not less than 12.3W; 10W Constant 40 c.p.s. to 9,000 c.p.s., giving a practically straight line of undistorted power throughout the audible range!

A–Z SENIOR 20 WATT
Ultra Linear.
Tone control is variable over a wide range thus ensuring comfortable listening level whilst providing contrast and balance of loud passages. Output not less than 20W; total harmonic distortion only 0.05%. Matching control provides compensation and attenuation for either reluctance, magnetic or crystal pickups.

To quote the "GRAMOPHONE" (London, Dec. issue) "IT'S A REVELATION!"

DEALERS! Get ALL the Technical facts NOW!
HI FI ENTHUSIASTS! Ask your dealer about A–Z Linear Amplifier Junior Mark II and the Senior A–Z Ultra Linear Amplifiers. If he hasn't yet got the facts ask him to please get them for you!

**PRODUCTS OF SOUND SALES LTD. ENGLAND.**

TRADE INQUIRIES ONLY TO:

**New Zealand Agents: TEE VEE RADIO LTD.**

BOX 5029 AUCKLAND

# NOW! THE FINEST NAME IN CAR RADIOS

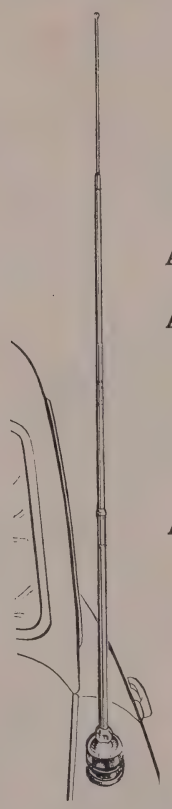
## BRINGS THE FINEST CAR AERIALS

*Extend your sales and boost your profits by displaying and fitting aerials which will appeal to every owner with pride in his car . . . aerials by*

SMITHS **Radiomobile**

## WHIP AERIALS

WITH 6 FT OR 8 FT MASTS



AW 903 — 6 ft. extended, 22 in. closed ..... Retail price 47s. 3d.

AW 902 — 8 ft. extended, 28 in. closed ..... Retail price 52s. 9d.
Both of these aerials have easy single-hole fixing and universal mounting for wing or fender.

## COMPLETELY RETRACTABLE

AW 603 — 6 ft. extended, 1½ in. telescoped ..... retail price 58s. 6d.
Single-hole fixing; 40 adjustment for vertical mounting on curved or sloping surfaces.

AW 603 - 6FT EXTENDED

**ROOF TYPE**

AR 32 S — 39 in. extended — friction ball joint — Universal roof mounting ..... Retail price 46s. 6d

AR 32 S — 39 in. extended — three-position parking from inside car — spring-loaded — universal roof mounting Retail price 58s.

All aerials are completely waterproofed and made of hard-drawn brass finished in nickel chrome to give lasting weather protection and smart appearance.

Inquiries to:—

**HIS MASTER'S VOICE (N.Z.) LTD.**

P.O. BOX 296 WELLINGTON

"HIS MASTER'S VOICE"

| | £ | s. | d. |
|---|---|---|---|
| Amplifier Cabinets, grey crackle finish, 11in. x 7½in. x 7in. | 1 | 15 | 0 |
| Pick-up Wire, very fine, single conductor, shielded ..... yard | | 1 | 0 |
| Electrostatic Tweeters | 2 | 5 | 0 |
| "ACOS" MIC22 Microphones | 5 | 10 | 0 |
| "SOLON" 625 Instrument Soldering Irons, 25w. | 1 | 2 | 5 |
| "ZEVA" Angle-bit 70w. Soldering Irons | 1 | 16 | 0 |
| "SCOPE" 6-second Soldering Irons | 2 | 3 | 6 |
| "SCOPE" Transformers | 2 | 6 | 3 |
| "B.J." Arms for perfect record tracking | 4 | 7 | 6 |
| "B.J." Adaptor Shells—takes most popular cartridges | 1 | 12 | 0 |
| 5 meg. and 10 meg. "LESA" Potentiometers, Linear | | 7 | 0 |

**Fear's of Willis Street**

31 WILLIS STREET, WELLINGTON, P.O. BOX 1243

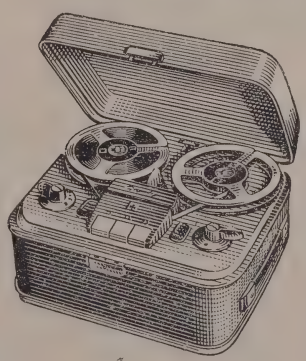
**Now** Two more brilliant **GRUNDIG** Tape Recorders!

1. THE GRUNDIG T.K.5
(illustrated)

A NEW "POPULAR" HIGH QUALITY MACHINE ALL CAN AFFORD

Many people have admired the Grundig Recorders but have not felt justified in making the necessary high expenditure. For those, the new TK5 is the answer. Brilliant engineering has retained the amazingly high standard of reproduction common to Grundig, yet simplified control to bring the price within the range of all. Push-button control; tape speed 3¾ in. per sec; tape capacity 850 ft. (1½ hours recording time).

PRICE ONLY: £99 10s.



2. THE GRUNDIG "3—D" MODEL TK 820 "SPECIALIST"

THE FINEST PORTABLE MACHINE YET DEVELOPED

"3 – D" Dimensional sound reproduction —that's one of the features of the new "Specialist". Three speakers—one bass and two treble—give speech reproduction true life and music such depth as never heard before from a portable recorder. Twin-track recording (giving 2400 ft. sound track per spool)—Two speeds (7½ and 3¾ in. per sec.) —Frequency range 40–14,000 cycles at 7½ in. per sec.

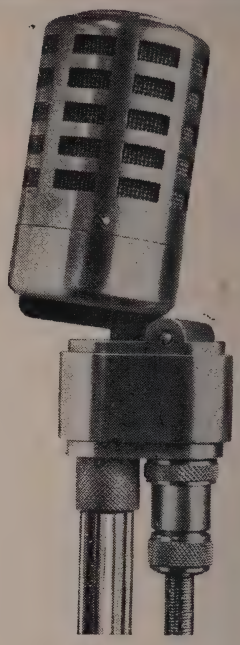
ON ALL TAPE RECORDERS GET BETTER RESULTS WITH B.A.S.F. TAPES

For FREE brochures and name of nearest dealer write to:

Sole New Zealand Importers:

**DIRECT IMPORTS (N.Z.) LTD., P.O. BOX 72, HASTINGS.**

# Reslo RIBBON MICROPHONE



Backed by more than 12 years' experience with these difficult instruments and a production infinitely higher than that of any other maker outside the U.S.A.

Frequency response flat within 2 db. over the range 50 to 9,000 c.p.s. for normal usage. Very close talking results in a small rise below 200 c.p.s.—a feature of value for some purposes.

Other RESLO PRODUCTS include a complete range of REFLEXED SOUND PROJECTORS, MICROPHONE STANDS, AND DRIVE UNITS.

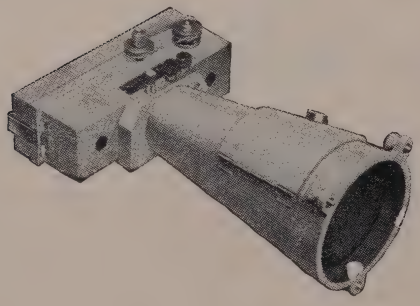
FOR FURTHER PARTICULARS CONTACT—

## AMALGAMATED WIRELESS (A'sia) LTD.

P.O. Box 830, Wellington. P.O. Box 1365, Auckland. P.O. Box 2084, Christchurch.

# COSSOR

## OSCILLOGRAPHS



**MODEL 1052 DOUBLE BEAM OSCILLOGRAPH**

A new Double Beam general purpose Oscillograph with a 4-inch diameter flat-screen tube, providing two amplifier channels of approximate gain, 2,000 each and an upper frequency response of better than 5 megacycles. The repetitive or triggered time-base has a sweep duration from 200 milliseconds to 5 microseconds with constant full screen deflection.

The Type 1052 Double Beam Oscillograph and mating Camera Type 1432 illustrated are but one unit of the wide range manufactured by Cossor instruments Ltd., England.

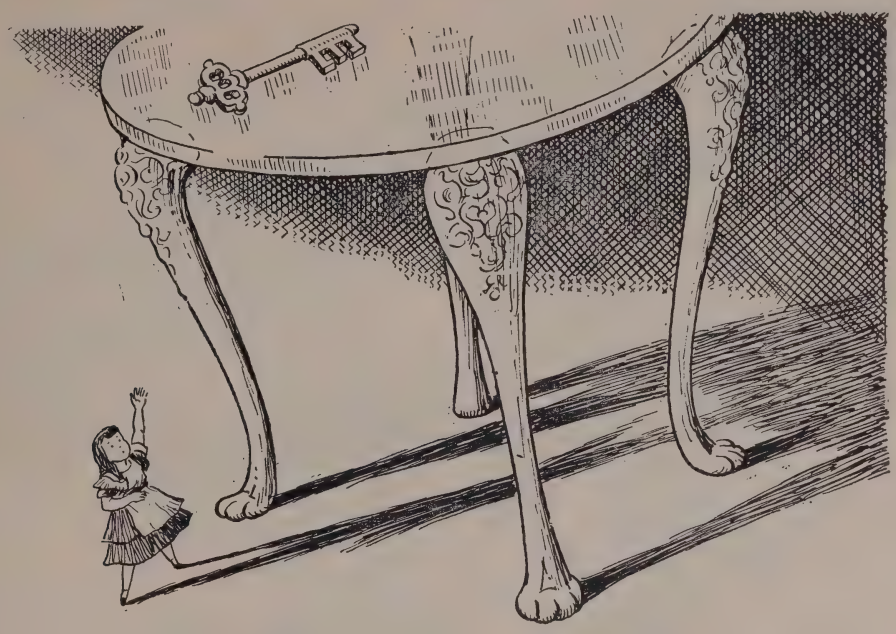
Sole Dominion Agents—

## B. R. HOMERSHAM LTD.

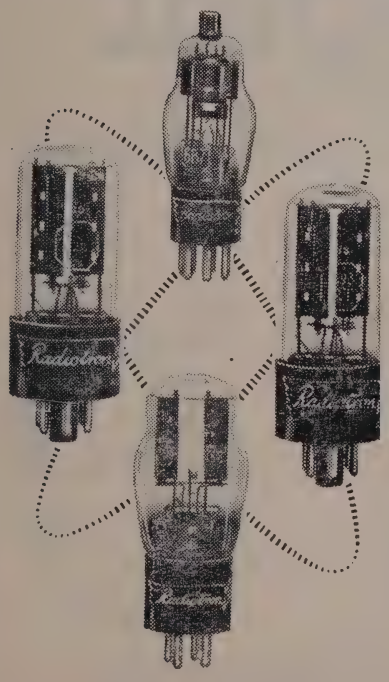
**Electrical and Mechanical Engineers. 126 Victoria Street, Christchurch. P.O. Box 280.**

Auckland Agent: W. & K. McLean Ltd., P.O. Box 48, Auckland.

Wellington Branch: B. R. Homersham Ltd., P.O. Box 572, Wellington.



# *Alice knew what she wanted . . .*



. . . the trouble was, it was out of reach. *Moral:* An out-of-stock valve is of no more use to a radio repair man than the key she couldn't reach was to Alice. So why not take advantage of New Zealand's most comprehensive and efficient supply service to stock up *now* with a complete range of 100% reliable Radiotrons? Eight Neeco Branches and a Dominion-wide network of Neeco travellers are ready to ensure you against bad-for-business delays, and your customers against disappointment. Your free monthly Radiotron stock list will keep you posted.

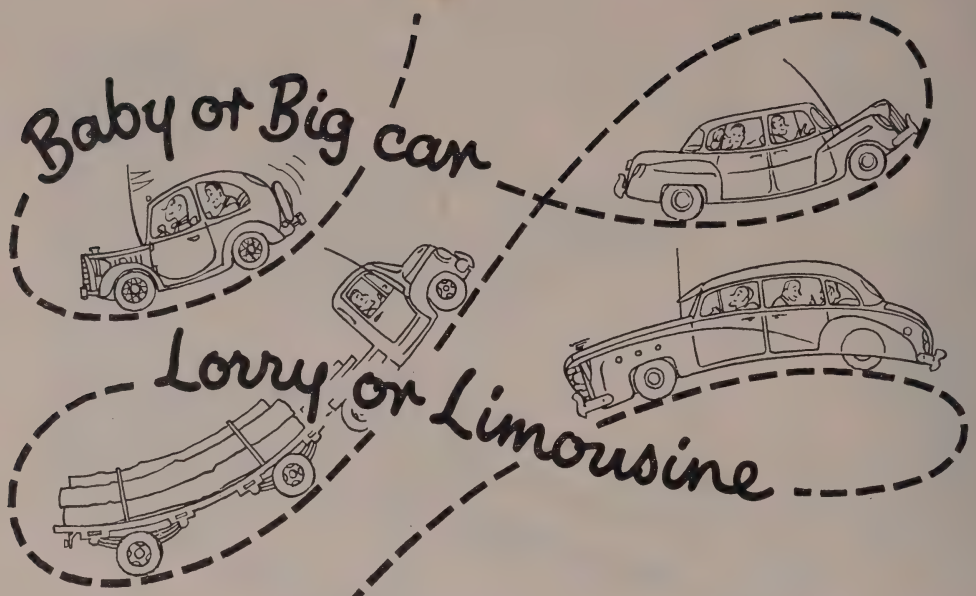
**RADIOTRONS**

FOR THE *RIGHT* VALVE AT THE *RIGHT* TIME!

Sole New Zealand Distributors:

**THE NATIONAL ELECTRICAL AND ENGINEERING CO. LTD.**

AUCKLAND - WELLINGTON - CHRISTCHURCH - DUNEDIN
HAMILTON - WANGANUI - HASTINGS - INVERCARGILL




# there's an Autocrat

AUTO RADIO

## to give you more smiles per gallon

You'll get more pleasure from motoring with an Autocrat in your car. Ask for a demonstration at your local dealers

**PORTABLE MODEL**
The only portable household car radio

**£34-12-0**

**UNIVERSAL MODEL**
The finest medium-priced radio

6 V **£32-10-0**
8 V **£36-4-5**

**5 VALVE MODEL**
Single unit, with a built-in speaker

**£26-0-0**

**PUSH BUTTON MODEL**
8 valves. Custom built for every modern car

**£37-19-6**

**DISTRIBUTED BY AUTOCRAT DISTRIBUTORS LTD., P.O. BOX 2364, AUCKLAND.**

MANUFACTURED BY AUTOCRAT RADIO LTD.

Branches : Box 1409 Wellington and 595 Colombo Street, Christchurch.

*Now available in N.Z. !*

# TELEFUNKEN TUBES

## LEADERS IN EUROPE FOR 50 YEARS

Made by the most famous of all German Electronic equipment manufacturers, Telefunken Tubes are impressive examples of German technical skill and efficiency developed over half a century! It is literally impossible to buy tubes of higher quality—yet they cost no more than ordinary run-of-the-mill tubes.

In stock now and ready for distribution throughout New Zealand.

Also available from A.W.A. and NEECO —immense stocks of A.W.V. Radiotron and R.C.A. tubes covering a complete range of American series makes.

Complete range of Continental types available for immediate delivery:—

| | |
|---|---|
| AZ41 | EL41 |
| DK40 | EL84 |
| EAF42 | UAF42 |
| ECH42 | UBC41 |
| EBC41 | UCH42 |
| ECH81 | UL41 |
| EF41 | UY41 |

etc., etc.

AND at regular prices.

ADDRESS YOUR INQUIRIES RIGHT AWAY TO THE NEW ZEALAND DISTRIBUTORS:

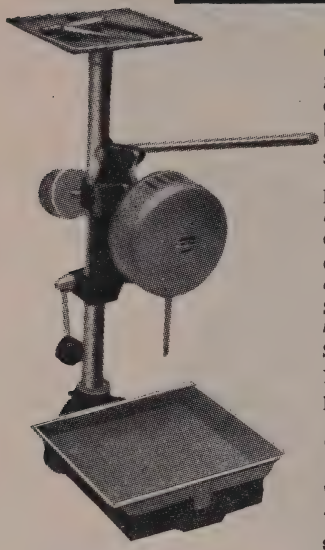
## AMALGAMATED WIRELESS (Australasia) LIMITED

P.O. BOX 830, WELLINGTON. P.O. BOX 1363, AUCKLAND
P.O. BOX 2084, CHRISTCHURCH.

AND AVAILABLE FROM: NATIONAL ELECTRICAL & ENGINEERING CO. LIMITED
(ALL BRANCHES)

## *Tungsten Carbide and Rubies . . .*

*machined by* **ultrasonics**



*Bench mounted 50W Ultrasonic Machine E.7680*

Glass, ceramics, tungsten carbide, synthetic gems and a host of other brittle materials difficult to machine, can be shaped with ease by the Mullard ultrasonic technique, using a soft cutting tool and an abrasive slurry.

**Holes of any shape**—*cut by high-speed reciprocating tool.*
**Cutting tools**—*made of mild steel or brass.*
**Close tolerances**—*as tight as 0.0005 in depending on fineness of slurry.*
**Smooth surface finish**—*9-10 micro-inches readily obtainable.*
**Simple to operate**—*as easy as a rotary drill.*
**No industrial hazards**—*no rotating parts.*
**No heating or stressing of workpiece.**

*Pedestal mounted 250W Ultrasonic Machine E.7690*

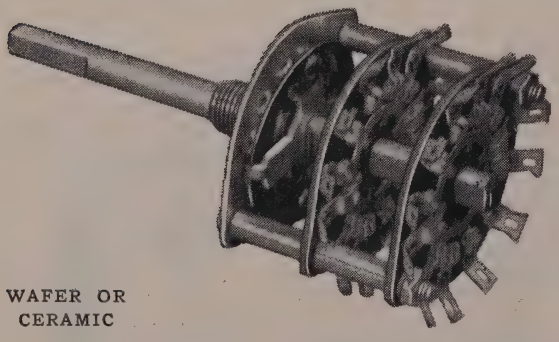
**Mullard**

**SPECIALISED ELECTRONIC EQUIPMENT**

ELECTRONIC DEVELOPMENT & APPLICATIONS CO. LTD.

102 WILLIS ST., P.O. BOX 799, WELLINGTON • ARGUS HOUSE, 26-28 HIGH ST., AUCKLAND

# OAK SWITCHES



WAFER OR CERAMIC

★ Made up to your own Specification
★ Single Switches or Quantity
★ Replacement Wafers or Complete Switches

**WISEMAN ELECTRIC CO. LIMITED.**
85 VIVIAN STREET, WELLINGTON
**P.O. Box 2020** **Telephone 55-272**

# HEATHKITS

*Quality instruments which judging by inquiries and orders received from prospective users, are arousing considerable interest throughout the country.*

5 in. OSCILLOSCOPE

Incorporates all the latest in instrument design, such as printed circuit boards for easier and foolproof wiring, push-pull amplifiers, high sensitivity, neatly laid-out panels and colour scheme. Uses standard tubes and parts, and, like all "HEATHKIT" instruments, all parts are supplied complete. The Instruction Book furnished with each kit gives a wire-by-wire description, enabling even a novice to wire up the kits in very short time and without any difficulty whatsoever.

RETAIL PRICE: ONLY £48 12s.

Write to us for name of your nearest dealer.
Trade Inquiries Direct to:

**FRED ROTHSCHILD & SON**

79-83 PRETORIA STREET
P.O. Box 170 —— Lower Hutt.

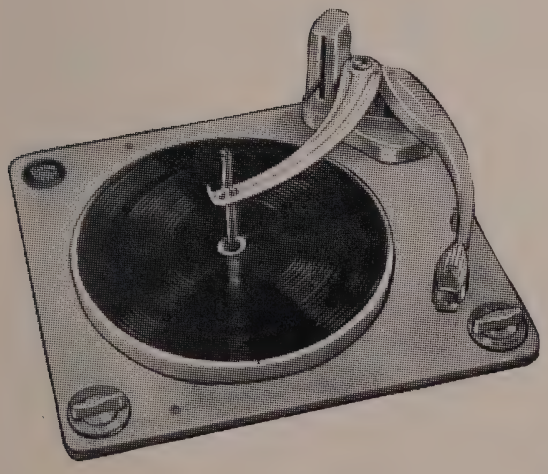
# TELL YOUR CUSTOMERS THAT COLLARO MAKES *GOOD SOUND* AND *GOOD SENSE* TOO

Your customer buys good records so that he can enjoy good sound. He fondles these records, and handles them ever so gently, because he knows that once the surfaces are marred, the quality will be gone forever.

He must realize then, that his record changer becomes an all-important factor in the matter of record quality. It must treat his records even more gently than he could himself, and it must contribute nothing which might impair the quality of the sound. Its tone arm must track at light stylus pressures and with free lateral compliance to protect the groove walls from wear. Its speed must be constant for correctness of pitch, and to avoid "wow". It must be free from rumble, and from audible resonances. It must retain and reproduce all of the quality in the record, protect it for future plays, and it must contribute no distortions of its own.

In the light of these requirements, examine the features of the COLLARO, and see if they don't meet all the exacting specifications that make this

## THE HIGH FIDELITY Record Changer for HIGH FIDELITY Reproduction



Only COLLARO has all these HIGH-FIDELITY features:

Intermixes 7, 10, and 12-inch records at all speeds. Steady, Constant Speeds — No rumble or Wow.

Weighted, Rubber-matted, rim-driven Turntable. Four-pole motor with Self-aligning Oilite Bearings.

No Hum Pickup.

Moulded Rubber Drives — No belts to slip or replace.

Automatic Muting Switch.

Stylus Pressure Adjustment—tracks at as little as 3 grams.

Absolutely jam-proof operation.

Ball-bearing mounted Turntable and Tone Arm.

Automatic shut-off after last record.

Tone Arm Clamp for Portable applications.

Base dimensions: 13½ in. x 12 in.

Depth below Base: 2½ in.

Model RC54

Retail £13 19s. 6d.

STOCKED BY LEADING RADIO RETAILERS EVERYWHERE

New Zealand Distributors:

**RUSSELL IMPORT CO. LTD.**

P.O. BOX 102 • WELLINGTON

**Collaro**

**FULLY AUTOMATIC**

**3-SPEED RECORD CHANGERS**

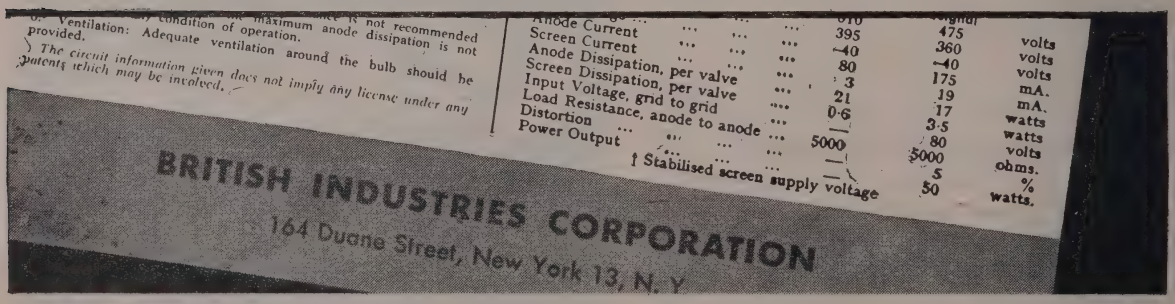
**for 7, 10 and 12 inch Records**

This is Britain's famous power amplifying tube... for years the favorite tube of experimenters and research laboratories; acknowledged in every country of the world to be the finest tetrode ever made. It is currently used in the Leak, Williamson, Radio Craftsmen and other fine amplifiers.
The KT66 is a versatile power tetrode with a number of useful applications. It may be used in the output stage of an audio-frequency power amplifier, either tetrode-connected for maximum sensitivity and power output or triode-connected for high quality working. In transmitting circuits using frequencies up to 30 Mc/s it may also be used as an oscillator or as a radio frequency amplifier.
A high slope, indirectly heated beam tetrode, the KT66 is suitable for either single or push-pull audio operation and may be employed as a beam tetrode with aligned grids. This alignment of the grids reduces losses in the screen and makes for the highest possible power conversion efficiency. With this system of construction high orders of power output may be obtained with a low screen dissipation, and the anode is designed to dissipate 25 watts continuously with a reliable life performance.
THE FINEST AUDIO TUBE EVER MADE!
KT66
DIMENSIONS
KT66
BASE
View looking on underside of base.
All dimensions are in mm. and are the maximum except where otherwise stated.
7-PIN "OCTAL"
Pin 1: Not connected
2: Heater
3: Anode
4: Screen Grid, g2
5: Control Grid, g1
6: Omitted
7: Heater
8: Cathode
RATINGS
Tetrode connected
Triode connected
Heater Voltage
Heater Current
Anode Voltage
OPERATING CONDITIONS
Single Valve A.F. Amplifier
Tetrode connected
Triode connected
Anode and Screen Voltage 250 400 250 volts
Bias Voltage -15 -38 -19 volts
Anode Current 85 63 60 mA.
Screen Current 6·3 — — mA.
Input Voltage 15 38 19 volts peak
Bias Resistance 160 600 315 ohms.
Anode Load Resistance 2200 4500 2750 ohms.
Distortion 9 7 6 %
Power Output 7·25 5·8 2·2 watts
Two Valves Push-Pull, A.F. Amplifier, Tetrode connected, Auto Bias.
(Data per pair of valves unless otherwise stated.)
Anode Voltage

# THE FAMOUS KT66 . . . IN USE ALL OVER AMERICA AND ACKNOWLEDGED TO BE THE FINEST BEAM TETRODE EVER MADE

# IS AN Osram VALVE MADE IN ENGLAND

*The photographic reproduction is taken from literature published in America by the British Industries Corporation and gives an entirely unsolicited tribute to this fine valve.*


Ventilation: Adequate ventilation around the bulb should be provided.
The circuit information given does not imply any license under any patents which may be involved.
Anode Current 395 475 volts
Screen Current 360 volts
Anode Dissipation, per valve 80 ~40 volts
Screen Dissipation, per valve 3 175 mA.
Input Voltage, gnd to grid 21 19 mA.
Load Resistance, anode to anode 0·6 17 watts
Distortion 3·5 watts
Power Output 5000 80 volts
5000 ohms.
5 %
50 watts.
† Stabilised screen supply voltage
BRITISH INDUSTRIES CORPORATION
164 Duane Street, New York 13, N. Y.

# A Problem For The Radio Industry

If there is one thing upon which the New Zealand radio industry can congratulate itself it is that it has proved to be one of the most efficient of our secondary industries. In view of the virtually complete protection it enjoys from overseas competition, this is most gratifying, because it would have been the easiest thing in the world for the industry to shrug off substantial increases in price with the usual plea of increased costs. For costs have increased, for the radio industry as for anyone else, and yet the price of sets to the public is lower now than it was before the war. In view of the lower value of the pound sterling, this means that prices have been drastically reduced since that time. We doubt whether the public, which recognizes a radio set today as a necessity rather than a luxury, realizes the fact. It should do, for there are very few necessities of life that have not suffered drastic price increases during the last few years.

Part of this benefit to the buyer has come about owing to the keen competition inside the radio industry itself, and it is probably safe to say that this is the major factor. It does, however, pose a problem which we hope manufacturers have realized, namely that competition in bringing prices down, if carried too far, ends in bringing values down too. This happens if a further price reduction is decided upon, to be achieved at any cost, even if this means a less satisfactory product. Our own opinion is that manufacturers in this country are aware of this pitfall; at any rate, they have so far avoided falling into it, and it is to be hoped that they never do.

There is one aspect of the trade though, that might quite easily perplex the public. It is the existence on the market of radio-gramophone combinations at prices ranging from £49 19s. 6d. to over £170. The price range alone is not the trouble. The difficulty as we see it is that the performance range by no means matches up with it. Add to this the fact that more and more people are hearing the excellent results obtainable from systems built up from separately purchased amplifiers, pick-ups, and speakers, and are realizing that many high-priced radio-gramophone combinations cannot approach these systems when it comes to quality, and it is open to anyone of an inquiring turn of mind to ask some questions that could be quite awkward. These days, records are so good that the user can easily, if he will, judge the quality of any playing equipment he may hear. If he should form the opinion that the range of performance between, say, the lowest and highest-priced console radio-gramophones is much too small to account for the wide divergence in their prices, he can only assume that someone is not being treated quite fairly, to say the least.

In our opinion there is a real danger that he may think this way, just as there is a danger that the indiscriminate use of the term "high-fidelity" to describe anything that is not an "ordinary" radio set is dangerous. The technical advantages of the last few years have been such that there is no need to gild the lily with redundant praises. All that needs to be done is for manufacturers to use some of the more advanced techniques in their higher-priced units, and to design radio-gram combinations in which some of the features that the quality enthusiast can well do without are omitted, and the saving in cost applied to building in better reproduction. There are a number of things that could be done in this way, but in the space available it is not possible to enumerate them. Nor is it any answer to the problem to say that the present-day radio-gram is what it is because the public wants it that way. The public will always recognize quality when it sees it (or rather, hears it) and the failure of pre-war attempts to bring out sets of better quality than the average is irrelevant today. As we have said before, the tremendous upsurge in the public interest in records since the advent of the L/P, together with improved pick-ups and speakers, proves beyond doubt that there is a market for high-quality reproduction. What we maintain is that in the higher-priced radio-gramophones the buyer ought to get it, but in the majority of cases he does not. It is still partly a matter of education, in that the buyer can be told, and shown, that a radio-gram does not *have* to have such things as automatic changers and bandspread all-wave tuners, but that at a comparable price it can have vastly improved reproduction.

We are well aware that some manufacturers do not believe this, and are not willing to try to bring it about, but it will come, and in our opinion there is a harvest waiting for the manufacturer who has the foresight and courage to try.

# AN INEXPENSIVE THREE-VALVE BROADCAST SET

*These days we find that very few constructors are interested in building five-valve sets. This set, using only two valves and a rectifier, should fill a need for a set for the home constructor that can be built more cheaply than the smallest commercial sets can be bought.*

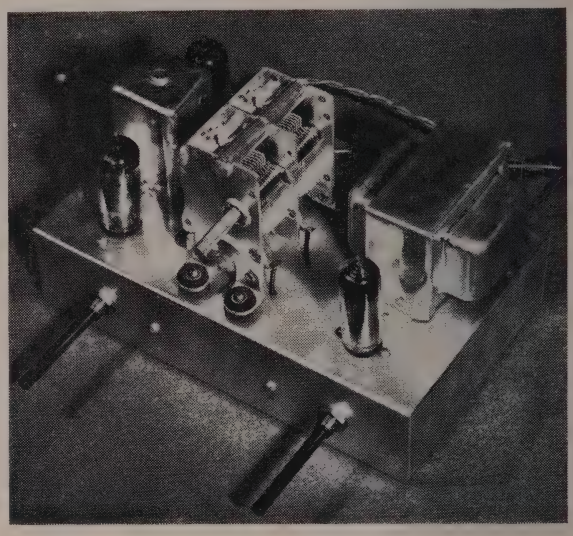
## INTRODUCTION

There used to be a time when no one at all interested in radio would have dreamed of buying a small broadcast set. He would have built it instead, for several reasons. First, there was the enjoyment to be had from constructing it; secondly, in those days anyone who could build even a crystal set (and make it work) was regarded as something of a wizard; and last, and this is important, it was quite a bit cheaper to build a small set than to buy it. These days, however, there seems to be very little enthusiasm for the construction of small sets. One reason for this is undoubtedly the transference of interest to high-quality audio amplifiers for record playing. Another is that radio reception for its own sake is almost dead. There are very few people today for whom a radio set is anything more than a means of receiving the broadcast programmes. Perhaps the most potent reason for the decline of the small set in amateur circles is the fact that it is now cheaper, as well as a lot less trouble, to buy a commercial four or five-valve set. The increase in the prices of components on the retail market, and the increased efficiency of the manufacturing industry have both contributed towards this state of affairs, as has the interest in high-quality reproduction. Anyone who builds himself a really good record-playing outfit is not very interested in anything but high-quality radio reception of the local stations, as our own correspondence has shown, together with such indications as the extreme interest shown in the synchrodyne and other high-quality broadcast tuners we have designed and described in these pages.

In spite of all this, we have thought for some time that a small broadcast set that really could be built cheaply enough to compete with the smaller commercial sets might be popular with our readers, and the set described in this article is the outcome. We should perhaps make it clear at the outset that the idea for the set is not original, the circuit being based on one designed by R. C. Leaver and described in "Wireless World" in March, 1955. All we have done is to take this design, and after making modifications that fit it better to our own conditions, build the prototype illustrated here, using components that are readily available anywhere in this country. The total cost of the parts, retail, will probably not exceed £10, so that if one's family is agitating for an additional set, it will certainly pay to put in the small amount of time required to build it.

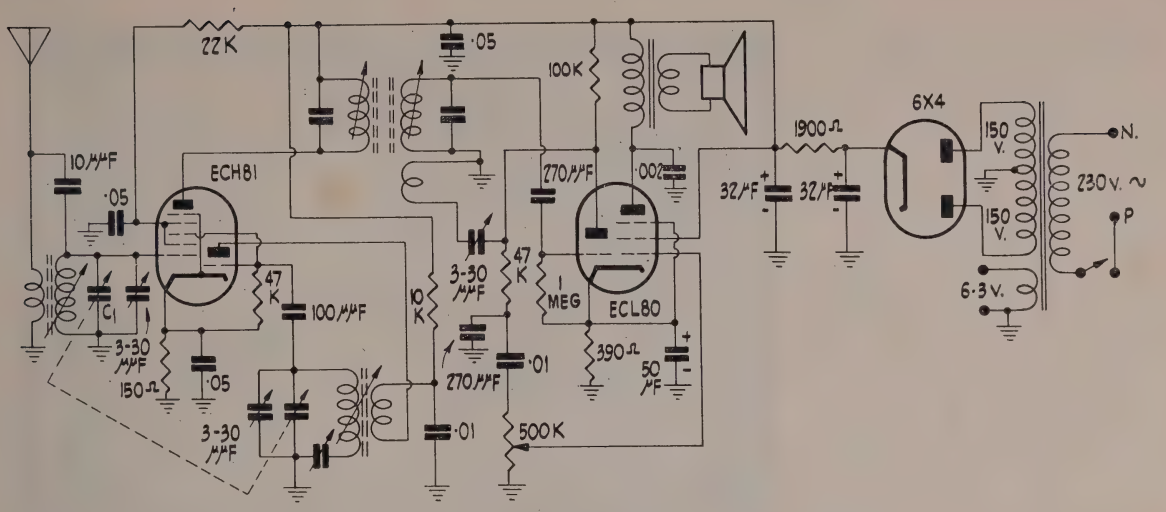
## SCHEME OF THE SET

The set has four working valves, in two envelopes. The first is an ECH81 triode-heptode, and is used as a quite conventional oscillator-mixer, converting the signal to the usual I.F. of 455kc/sec. As far as the secondary of the I.F. transformer, the circuit is similar to that of any ordinary four or five valve



superhet. There is no I.F. amplifier stage, the I.F. transformer feeding the detector valve directly. The latter is the triode section of an ECL80, of which the pentode section is the power output valve. The power output is approximately 1 watt. In order to make up for the lack of both an I.F. amplifier and an audio stage in front of the output valve, a regenerative grid leak detector is used. This gives almost as much signal amplification as an A.F. amplifier stage, while the regeneration goes part of the way towards making up for the loss of amplification involved in omitting the I.F. amplifier.

Since the regeneration takes place at the fixed intermediate frequency, it is possible to use a pre-set regeneration control. The I.F. gain will not need to be controllable from the front panel, because its effect will be the same, being at I.F., regardless of the signal frequency. Thus, one obtains the advantage of regeneration without its most serious disadvantages. Since a set of this nature is not intended except as a local station receiver, there will be no occasion for the regeneration to be set at all close to the point of oscillation, because the R.F. gain will be adequate even when only a moderate amount of regeneration is used. Thus, when the A.C. line voltage rises, as it sometimes does, there will be no tendency for the regeneration to "spill over" into oscillation. Similarly, it is unlikely that any change in the regeneration control will be required even when valves are changed.




It would have been possible to make the set with only two valves, using a metal rectifier in a half-wave circuit for obtaining the H.T. voltage. The main reason why this was not done is that the valve rectifier is cheaper, and just as satisfactory in service.

## CIRCUIT DETAILS

The oscillator-mixer circuit hardly requires any comment, as it is perfectly ordinary. The ECH81 is a good choice of valve for this set, not only because it uses the same base as the other tubes, but because of its high gain. It had been thought, before the set was constructed, that it would lack sensitivity, and would be restricted to very large-signal areas, but this is not so. The sensitivity, while not up to that of a conventional set is never-the-less more than adequate for local stations, and is capable of bringing in quite weak signals at good volume. The ECH81 contributes to this performance quite materially, so that those who might wish to substitute another type for the ECH81 are advised against this course, particularly if they would like to keep the sensitivity as high as possible. The values of the screen and oscillator plate dropping resistors have been chosen taking into account the fact that the main H.T. line is only 170 to 180 volts.

The second detector circuit is somewhat unusual, if only because most of us have these days forgotten what a grid leak detector looks like. The plate load is a 100k. resistor, which allows enough amplification to take place at the intermediate frequency to enable regeneration to be obtained. The tickler winding, which the constructor must add himself to the I.F. transformer, is connected in series with the 3-30μμfd. Philips trimmer which is used as the regeneration control, and the combination is connected between the detector plate and earth. There is an I.F. filter between the plate of the detector and the volume control potentiometer. This comprises the 47k resistor and the 270 μμfd. condenser. A point to be noted is the use of a small coupling condenser of only 0.01 μfd. between the filter and the volume control. This gives a small amount of attenuation at frequencies below 100 c/s., and thus helps to reduce hum and low-frequency noise that is picked up by the tuner. In a set like this, which will almost certainly use a small speaker in a minute cabinet, low audio frequencies will never be reproduced, and cutting the extreme lows is a considerable advantage. Also, in order to preserve some kind of balance, it is essential to limit the high frequency response. This is partially done for us by the selectivity of the regenerative I.F. section but the use of 270 μμfd. in the I.F. filter instead of a smaller condenser helps in this respect. In addition, there is a 0.002 μfd. condenser across the primary of the output transformer in order to limit the spurious high-frequency response that is obtained from a pentode without negative feedback. Note that the detector grid leak is returned to the ECL80 cathode, and not to earth. If it were, there would be fixed bias applied to the detector.

## COMPONENTS

The only non-standard component in the set is the 455 kc/sec. I.F. transformer with the reaction winding. Such transformers are not commercially available, but it is a simple matter to add one's own reaction coil to a standard transformer. It will be noted that we have used a normal-sized I.F. transformer for the purpose, the reason being that it is a much more difficult job to add the extra winding to a midget type. In any event, there is no reason for using a midget transformer, since the highest component on the chassis is the gang condenser, so that no space would be saved by using the smaller component. To put on the reaction coil, the transformer is first taken carefully out of its can, and the winding is identified which is used as the secondary. It will be noted that the base of the transformer has provision for six leads to be brought through it, two of the holes being unused. First of all, then, pieces of tinned copper

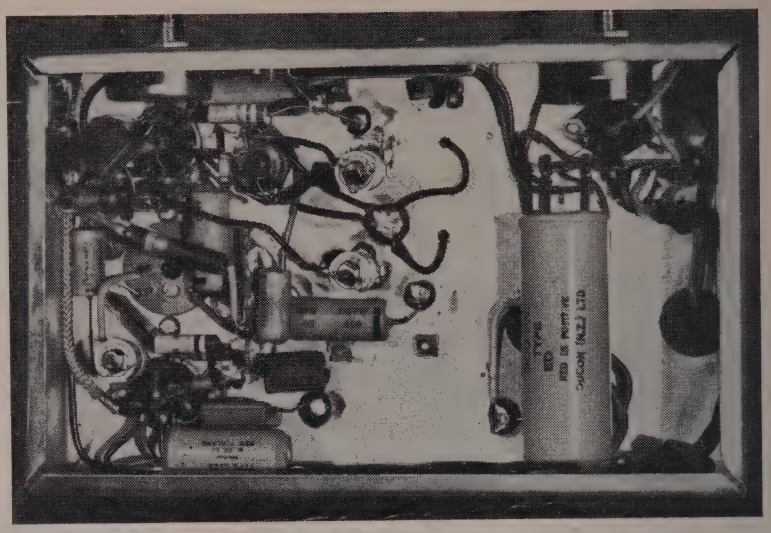
*Aerial and Osc. Coils.*—Standard unshielded coils, to suit gang used.

*I.F. Transformer.*—Large-sized slug-tuned type, reaction winding added when constructing set.

*Output Transformer.*—10,000 ohms to voice-coil.

*Oscillator Padder.*—600 μμfd.

wire are pushed through these holes to act as terminations—on the inside for the fine wire of the new winding, and on the outside for connection to the circuit. It is best to make these connecting wires a push fit into the holes if this is possible, but in any event, it is possible to solder them to the metal eyelets that line the holes, making it impossible for them to be accidentally pulled through when the transformer is back in its can, and being wired up to the circuit. Leave plenty of length (about two inches) on the outside of the can, and this will then make it unnecessary to solder up to the connecting wires when the set is being wired up. One wire is taken to the chassis by as short a route as possible, and soldered there, while the other goes to one side of the Philips trimmer that is used as a pre-set regeneration control. Having identified the secondary winding of the transformer, the new winding can be put on, jumble fashion, making sure that the turns are put on in the same direction as those of the secondary itself. Quite fine wire, about 36 S.W.G., should be used, and 30 turns are put on, winding them as close as possible to the secondary. When they are on, they can be fixed in place with coil dope or with wax, melted on to the winding with the soldering iron being careful not to touch any of windings with it. The start of the winding is the end that should be connected to the reaction condenser, and the finish, to earth. This will give the correct polarity for producing regeneration, provided the coil is wound, as directed, in the same direction as the secondary to which it is coupled.



The output stage requires a load impedance of 11,000 ohms, according to the valve data sheets, but this is not a standard value for available output transformers. However, 10,000 ohms is a common value, and so the speaker should be bought with a transformer to match 10,000 ohms to its voice-coil.

## CONSTRUCTION

Two photographs and a working drawing for the chassis are given in this article, and should serve to indicate the type of construction used in the prototype. No attempt was made to make the set ultra-compact, as this adds to the difficulty of construction, which with the lay-out shown is non-existent. Also, a very compact set-up sometimes makes it difficult to obtain complete stability, even with a simple circuit like this one. The chassis measures 8 in. x 5 in. x 2 in., and as can be seen, this gives plenty of room and avoids crowding of the parts both above and below the chassis. On the left hand side of the chassis we have the power transformer and the rectifier valve, while on the other side we have, from front to back, the ECH81, the I.F. transformer, and the ECL80. The aerial and oscillator coils used were the unshielded variety, and both of them are mounted under the chassis. As they work on different frequencies, there is no need to shield them from each other, but it is advisable to place their axes at right angles, so that oscillator voltage will not be induced in the aerial coil, and enter the circuit via the control grid of the ECH81 as well as by the oscillator electrodes. The volume control is at the left hand side of the chassis, so as to be as close as possible to the circuit, while the corresponding control on the other side is an A.C. switch only. In front of the switch and the rectifier socket is screwed a strip holding four insulated solder lugs. Two of these are used to terminate the A.C. leads, while the other two are used for the "hot" ends of the dual 32 $\mu$fd. electrolytic smoothing condenser. The 1900 ohm smoothing resistor is a new type that has recently appeared on the market. It is moulded in plastic, and has a metal strap surrounding it, making at the same time two mounting lugs by which it can be fastened to the chassis without any danger of short-circuits. The strap, being in contact with the metal chassis, helps to conduct heat away from the resistor, which runs quite cool in practice, and does not therefore heat up adjacent parts by radiation. Two large and stiff solder lugs are provided on it for the resistance element, and owing to the firm mounting, these can also be used as tie-points for other parts of the wiring. This resistor is mounted in the middle of the front of the chassis, but it cannot be seen very well in the photograph because this is taken looking vertically downwards, so that the resistor is shielded from view by the folded-in edge of the chassis.

The two Philips trimmers in the middle of the chassis are those belonging to the aerial and oscillator circuits. Just beside them are holes through which the stator leads of the gang condenser are brought. Just to the left of the upper one in the photograph is the aerial coil, mounted vertically. The oscillator coil is mounted on the left hand side of the chassis, and thus is supported horizontally, just in front of the ECH81 socket in the photograph. To the right of the I.F. transformer base, which can be seen in the photo, is a strip of insulated lugs. All other components find tie-points on the valve sockets, coil lugs, etc., and as a cadmium plated chassis was used, it is an easy matter with a hot soldering iron, to solder earth connections from bypass condensers and the like directly to the chassis.

## ALIGNMENT

The alignment of this set is no different from that of any other superhet, except that there is the fixed reaction control to be set. However, this can be done after the rest of the set has been aligned. If the reaction condenser is screwed right out, giving minimum reaction, all that happens is that the sensitivity is reduced. In this condition, the set can be lined up in the conventional way using a signal generator and an output meter, or failing these aids, by ear, using stations as signals, and the ear as an output meter. However, if one possesses a multi-range meter, it is far better to use it as an output meter, by setting it to one of the A.C. ranges and connecting it across the primary of the output transformer.

The usual procedure is followed of tuning in a signal at about 1400 kc/sec., with the oscillator trimmer set at half way. Then, the aerial trimmer is adjusted for maximum signal. After this, a signal near 600 kc/sec. is tuned in, and the padder is adjusted, together with the main tuning dial, until the setting is found which gives greatest signal output at this frequency. After this, return to 1400, and check the aerial trimmer again. Initially, if one has a signal generator, it is best to align the I.F. transformer first. If the job has to be done without a signal generator, it is better to leave the transformers as they come from the manufacturer, as they are sent out after alignment in a test rig to the nominal frequency of 455 kc/sec. This does not mean that they will not need alignment, but only that they will probably be close enough to correct tuning to enable the initial alignment of the set to be carried out. After the R.F. section has been aligned, therefore, one can tackle the alignment of the I.F. transformer, and the setting up of the reaction control.

First of all, screw in the reaction condenser slowly, and note whether, as this is done, the main tuning dial has to be shifted in order to keep the signal tuned in properly. Should this be found, it is an indication that the I.F. transformer as a whole is not aligned quite to the frequency at which the secondary circuit peaks when the reaction is applied. The effect of the reaction is to sharpen up the response of the I.F. transformer secondary, at the same time as it increases the total amplification of the set. Because of this, the secondary will control the frequency at which the set peaks, when the reaction has been turned up. The best way of aligning the set after the reaction has been turned up is to re-tune, NOT the main dial, but the windings of the I.F. transformer. The method that should be used is as follows:

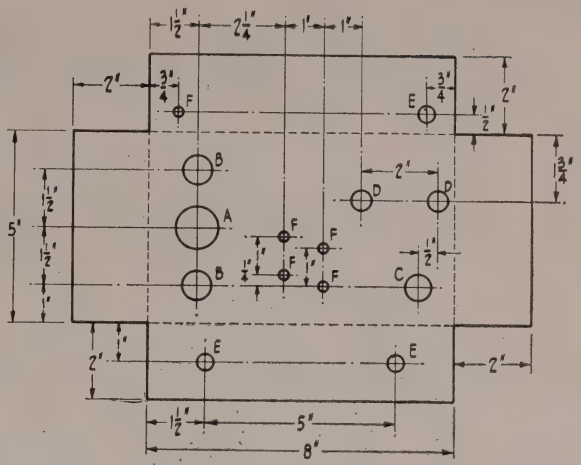
(1) Tune in a signal as accurately as possible, with the reaction condenser set at minimum capacity. After this initial step, the main dial is left untouched.

(2) Turn up the reaction condenser until a noticeable increase in volume takes place. If it is found that when this is done, the detector goes into oscillation, back off the reaction until the oscillation stops.

(3) Carefully re-tune the PRIMARY of the I.F. transformer. It will be found that a new setting will be found for maximum volume.

(4) Try a further SLIGHT increase in the capacity of the reaction condenser. It will probably be found that this can now be done without the detector oscillating.

(5) Re-peak the transformer primary once more.




DRILLINGS: A = 1⅛" Dia. B = ¾" Dia. C = ⅝" Dia. D = ½" Dia. E = ⅜" Dia. F = ¼" Dia.

Having got thus far, it is necessary to decide whether the reaction being used is too great or not great enough. This will depend to some extent on the aerial being used, because the aim in adjusting this set is not to adjust it for maximum sensitivity, as one does with an ordinary regenerative set, but to bring the sensitivity up with the regeneration just far enough to give the set the sensitivity needed for good reception of the main stations in the vicinity. There is one very good reason for this. If a great deal of regeneration is used, making the set as sensitive as possible, two undesirable effects occur. First, the selectivity becomes so great that there is very bad high note loss, and the reproduction sounds very "woofy", just as if a tone control had been turned down too far. Second, and even more important, the use of too much regeneration introduces distortion into the audio output. In the case of a conventional regenerative set, where sensitivity is the main consideration, this distortion is seldom noticed, nor does the operator worry about it if it is, but when the set is to be used for normal listening to musical programmes, it can be most distressing. However, as long as too much regeneration is not used, this distortion will not be apparent.

## PLESSEY RESEARCH LIMITED

News has been received of the formation of another company within the Plessey Group, to be known as Plessey Research Limited.

During recent years the Group has founded research establishments in various parts of the United Kingdom on projects ranging from basic research through to component development, and application research of various types.

These establishments are in many instances working on secret Government projects, although a high proportion are devoted to commercial research and development spanning a wide range of engineering interests.

These activities have now reached the point where the Board has decided it is necessary to unify and bring together the control of all these units, in order to achieve the maximum long term results.

*Amateur Transmitting*

# A TRANSMITTER WITH SOME UNUSUAL FEATURES

*It is not often these days that an A.M. 'phone transmitter posseses anything of unusual technical interest, but the following article, based on information supplied to this journal by Mr. D. C. Sutherland, ZL2AJL, shows that traditional "ham" ingenuity is far from dead. Not everyone will wish to duplicate such a design for himself, but the circuit contains so many unusual features of undoubted value, that we are sure that many of our amateur readers will find a use for some of them.*

## INTRODUCTION

In a 'phone transmitter of any power, one of the most expensive portions has always been the modulator. If the most is to be made of the capacity of one's R.F. final stage, and if the maximum allowable input of 100 watts to the final is to produce the greatest possible signal output, there is no question of using one of the many efficiency-modulation schemes, such as grid, screen, or suppressor modulation, since in general these arrangements are much less efficient. This leaves only high-level modulation, namely plate modulation in the triode case, and plate-and-screen modulation for tetrodes and pentodes. Various schemes have been used to make high-level modulation less costly, as for example, the use of Class B modulators, but these usually pay reasonable dividends only at considerably higher power levels than those at which amateurs are allowed to work. For medium power, the Class B modulator has several disadvantages. In the first place, its H.T. current varies over a wide range according to the modulation level. This makes a specially well regulated power supply almost essential. Secondly, a small power amplifier is needed to drive the modulators, and this driver must be of high quality, and requires a relatively expensive driver transformer. Finally, the operating conditions for a Class B modulator system are quite critical, and need careful adjustment if the resulting modulation is not to be badly distorted. Some relief from these difficulties is obtained by using modulator valves that are designed for large power output using Class $AB_1$ or $B_1$, since resistance-capacity coupling can be used at the modulator grids, and the driver stage is not called upon to provide grid current for the modulators. However, this kind of modulator often requires a power supply that is just as well regulated as that of a Class B stage with grid current, and this constitutes a major item of difficulty and expense to the amateur transmitter.

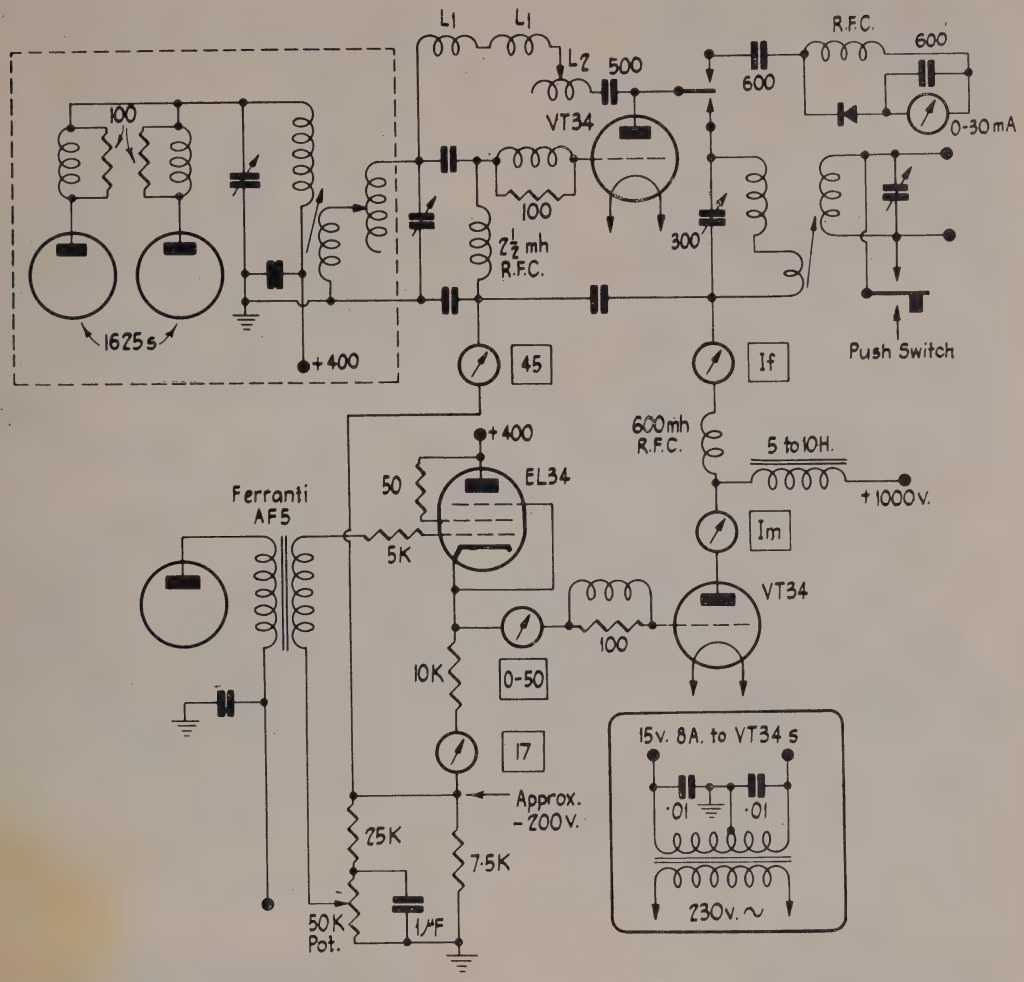
## A CLASS $A_2$ MODULATOR

In an attempt to overcome some of these difficulties, ZL2AJL has designed, and has been operating for some time, a most unusual modulation system, which is single-ended, and which uses Class $A_2$ operation of the sole modulator valve. That is to say, the modulator is biased as for Class A operation, but is driven into grid current. At first sight, this looks like an impossible scheme, because everyone knows that a single valve, driven into grid current, produces violent distortion. Or does it?

The answer to this question is not a clear-cut one, because, in the words of the wise, it all depends. First of all, it depends on the type of valve concerned. For example, the filament or cathode must be ample to supply enough electrons not only for the plate circuit, but also for the grid, when the latter is driven positive. However, most large valves that might be used with this system are likely to satisfy this condition quite well. The main consideration, however, is that of the grid drive. Any driving stage for a stage which draws grid current must deliver real power, so that it must be designed as a power amplifier, capable of providing the power drawn by the modulator grid circuit, without distortion. One way of doing this, popular in Class B modulators, is to have a driver stage coupled to the modulator grids by a step-down transformer. Another way, also used with Class B modulators is to drive the grids with a pair of fairly large valves connected as cathode followers. This is the scheme that has been used by ZL2AJL. The driver is an EL34, working with a static plate current of 17ma. The total cathode resistance is some 17.5 k, and the grid of the modulator is directly connected to the EL34 cathode.

Now a well-known property of the cathode follower is that its internal resistance, looked at backwards from the position of the load, is very small—only a few hundred ohms at most. Another way of saying the same thing is that the cathode follower acts as a voltage regulator for the output signal being very insensitive to changes in the load resistance. In the example in the diagram, the cathode load is only light as long as the modulator is not drawing grid current. When grid current starts, the effective resistance of the VT34 grid circuit is connected in parallel with the 17.5k cathode resistance of the EL34, reducing the effective cathode load resistance for the latter. The harder the EL34 is driven, the more grid current the VT34 takes, and the lower becomes the EL34 load resistance, but because it is a cathode follower, it is able to supply the signal across the low effective load resistance (a) with very little falling off in the expected signal voltage, and (b) with very little distortion. In use, the plate current of the EL34 swings up markedly, but the current through the 17.5k cathode resistance remains constant, showing that the average cathode voltage does not change, and also that the power represented by the increase in EL34 plate current is going into the VT34 grid circuit, where it will show up (and does) as grid current.

Of course, this action cannot go on indefinitely, but there is more than enough modulator grid swing available to enable approximately 90% modulation to be obtained in a very linear fashion. Thereafter, flattening of both positive and negative peaks takes place simultaneously, so that the whole modulation system acts as a high-level clipper, preventing overmodulation and splatter. What is more, since this limiting is taking place at the highest power level in the transmitter, there is no possibility of reintroducing unwanted sidebands, as often happens




when speech clipping is done at a low audio level. The tracing of a trapezoidal modulation pattern sent to us by Mr. Sutherland shows that extremely linear modulation is obtained up to 90%, followed by a smooth clipping action on both positive and negative peaks.

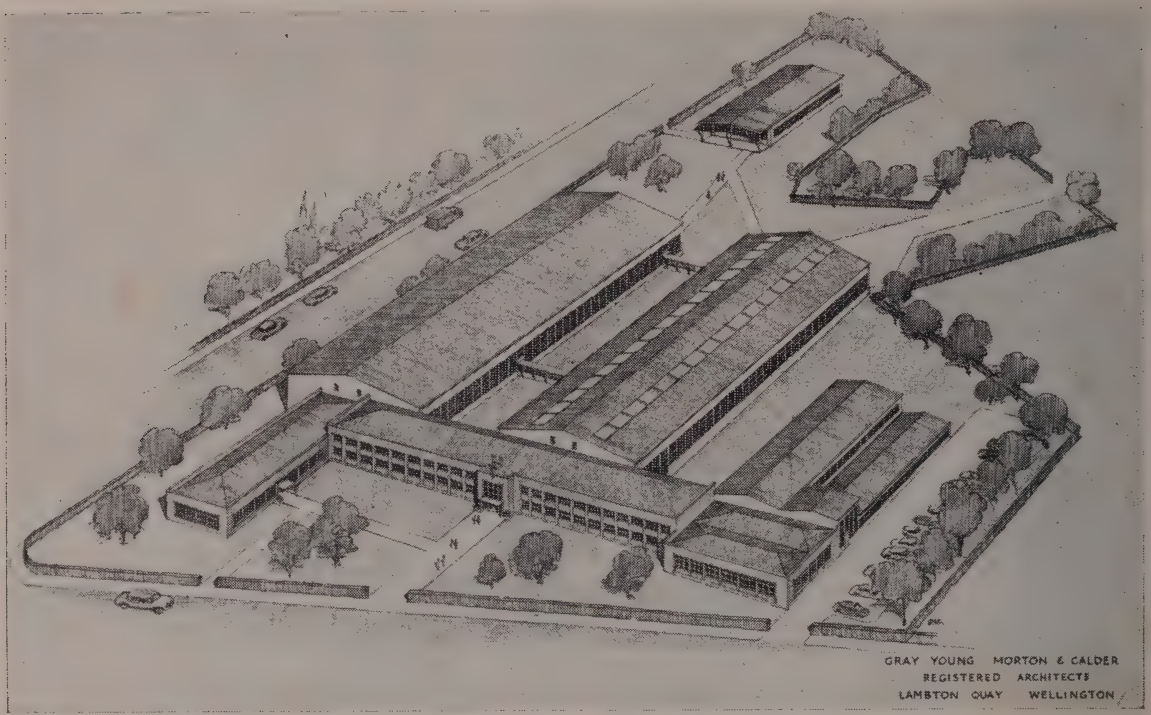
## CIRCUIT FEATURES

It is one thing to think up such a scheme, but quite another to put it into practice, and in this latter department, ZL2AJL surely earns full marks. The practical difficulties are mainly concerned with providing flexible biasing arrangements both for the final amplifier, the modulator, and the driver. A glance at the circuit diagram will show how this has been done. The VT34 is a British war-time transmitting tube, with characteristics similar to those of the Marconi DET3, and is not a tube that many amateurs are likely to possess. It has a relatively high amplification factor of 19, a high mutual conductance of 6 ma/v., and thus a low plate resistance, of approximately 3200 ohms. Its filament takes 15 volts at 4 amps, and its maximum plate dissipation is 250 watts. Such tubes do not function efficiently at low plate voltages, so that even for the low power input of 100 watts, allowed by the P. and T. Department, it is advisable to use a plate voltage of 1000. The same supply feeds the modulator through a large modulation choke. The first, and most obvious problem is how to secure the correct operating bias for the modulator, when its grid is tied to the cathode of the driver. If the latter has a plate current of 17 ma., through a cathode resistor of 17.5k total, the cathode can be expected to be at a potential of some 278 volts positive with respect to earth. This would hardly be a suitable potential for the grid of the modulator. ZL2AJL has tackled this one in the following way. He has plenty of drive available for the final amplifier from a pair of 1625S, in a BC458A command set, which he has modified for 80 metre operation. It will be seen that the lower, 7.5k portion of the EL34 cathode resistor acts also as the grid leak for the final amplifier, and that a grid current of 45 ma. flows through it, in the upwards direction. At the same time, there is the 17 ma. of static plate current from the EL34 flowing through this resistor in the down-

(Continued on Page 30)

# RADIO INDUSTRY TO HAVE A "NEW LOOK" AT NAENAE

## PHILIPS NEW PRODUCTION CENTRE WILL BE SET IN GARDENS




This year the New Zealand radio industry will undergo its major development with the construction of the new Philips production centre on a six-acre site at Naenae in the Lower Hutt Valley.

This development, now under way, is of special interest on two main accounts. Firstly there is the "new look" of the environment in which employees will work. Secondly, the layout provides for manufacture of more electronic articles specially adapted to New Zealand conditions, including commercial television receivers, at a time when the Government is encouraging such steps towards the country's industrial independence.

Experience of production enterprises in 27 countries has been used in planning both the environment of the production centre and the work to be done there.

Mr. Leighton Lord, Managing Director of Philips New Zealand, is firmly convinced that the quality of work is strongly influenced by the environment in which it is done.

In accordance with his company's policy of social advancement, the Naenae production centre is set in attractive surroundings with grounds laid out in gardens. All the working rooms are designed to have windows close to the floor so that staff have the benefit of viewing the gardens from their tables.

The colour scheme and lighting have been worked out to give maximum visual comfort, in accordance with recommendations of the recent International Lighting Congress, whilst noise disturbance will be cut to a minimum by ceilings of acoustic tiling.

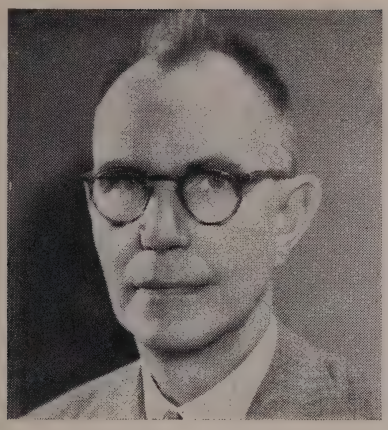
Provisions for staff social activity include a modern dining hall and separate social hall for dances and concerts. A Personnel Department is devoted expressly to staff welfare.

"We believe that these amenities are part of modern working life," said Mr. Lord. "They engender the co-operative spirit by which everybody does his or her best."

A glance at the plan shows that the new production centre has been located to give maximum convenience to employees, many of whom will be Hutt Valley residents.

The main entrance block is a two-storey building set back from Vogel Street, the intervening space being an expanse of lawns patterned by shrubs and flowers. It thus faces the Naenae Community Centre with its adjacent tennis courts, bowling greens and the Naenae shopping centre.

The whole front will be finished in multi-coloured brickwork. It houses offices at the left, the dining hall



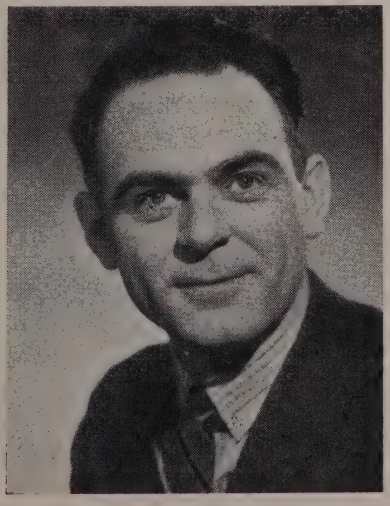
*Mr. Leighton Lord, Managing Director of Philips New Zealand.*

at the right with the factory portion in between, finished in coloured cement. Production lines and stores will also be housed in the three bays extending back from the main block, the bay fronting Naenae Road being the main production shop. It has a floor specially designed to eliminate dust.

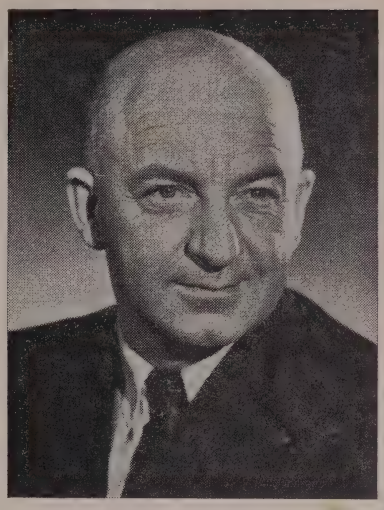
The building is planned so that most of the work will be done under good natural daylight. However, all sections will be equipped with new-type fluorescent fittings manufactured by the company.

W. M. Angus Ltd., contractors, have scheduled to have the first portion of the building finished and ready for occupation within twelve months. They are working to the plans and specifications of architects, Gray Young, Morton and Calder.

When completed the production centre will cover 45,000 sq. ft. The present staff will be doubled in number and there will be new production shops for



*Mr. Ivan Webb, Philips Sales Manager.*



*Mr. Ralph Slade, Managing Director of sister-company E.D.A.C., who will make electronic equipment at Naenae.*

*Mr. Eric Undrill, Factory Manager.*

metalwork and painting. The two main product lines will be radioplayers and fluorescent fittings, but the layout makes special provision for a TV set production line which will be ready to go into action as soon as the Government gives the signal.

"This is the best indication of our TV intentions," said Mr. Lord. "From the production point of view Philips are equipped to comply with any technical or material standards laid down by the Government.

# A Transmitter With Some Unusual Features

(Continued from page 27)

wards direction. There is thus a net 28 ma. flowing upwards in the 7.5 k. resistor. The junction of the 10 k. and 7.5 k. resistors is therefore at a potential of approximately — 200 v. Now there is still the 17 ma. flowing downwards through the 10 k. portion of the EL34 cathode resistor, so that there is a voltage drop of 170 volts across this resistor, making the cathode of the EL34 170 volts more positive than the point labelled — 200. The EL34 cathode is therefore at a negative potential of some — 30 v. with respect to ground. The actual figure will be nearer — 26 v., which places the bias for the modulator not far from the middle of its grid characteristic curve.

Next, there is the question of bias for the EL34 driver itself. Transformer coupling is used, because quite a high signal voltage is needed to excite the driver, and transformer coupling is the easiest way of obtaining this. Across the 7.5 k. portion of the EL34 cathode resistor, it will be remembered, the potential is negative with respect to earth. The cathode of the EL34 is at about — 26 v., so that somewhere up the 7.5 k. resistor it will be possible to pick off a suitable D.C. potential for the grid of the EL34. This is done by connecting a high-resistance voltage divider across the 7.5k., the lower portion being made from a 50 k. potentiometer, the slider of which is made the grid return for the EL34. Once the final amplifier's grid current has been adjusted to the correct figure, by using the R.F. driver's coupling adjustment, the EL34 grid bias can be adjusted to give the required modulator grid bias. This will automatically give the correct bias for the EL34 at the same time.

Of course, if one wants to avoid interaction between the R.F. drive level and the D.C. operating conditions of the A.F. driver and modulator, it would be possible to return the EL34 cathode circuit to a conventional power supply, negative with respect to earth, instead of to the final's grid, but the method shown, very elegantly avoids the necessity for an auxiliary negative power supply.

## OTHER FEATURES

There are several other features of ZL2AJL's transmitter that could well be recommended to others. One is the use of inductive neutralization. This system is very rarely used by amateurs, but gives such accurate neutralization that it is often found in high-powered transmitters, such as those used by broadcasting stations. Its only disadvantage from the amateur point of view is that it needs rather more frequent adjustment with frequency changes than do the more conventional methods. However, with the method used here of indicating correct neutralization, it presents no difficulty, and its good features can be made use of. The plate tank circuit is completed through the contacts of a relay (a vacuum type, suitable for use in R.F. circuits) in such a way that the plate of the final can be switched away from the tank circuit, to a neutralizing indicator, which is nothing more than a shunt rectifier circuit, using a crystal diode, and a meter for indicating the diode current. The principle of inductive neutralization is very simple. It is to place sufficient inductance in parallel with the grid-plate capacity of the valve, to tune it to the operating frequency. We then have a parallel-tuned circuit, connected between grid and plate. At the operating frequency, this looks like a very high resistance, so that the effect of the grid-plate capacity is removed, and measurable quantities of regeneration cannot take place. With this system, it is not necessary to have the plate tank circuit connected, because this plays no part in the neutralization. Another interesting feature is the method used for checking the tuning of the final amplifier, without having to alter the coupling to the aerial tuner. The push switch on the aerial coupler enables the latter to be short-circuited. The procedure is to press this switch, then tune the final amplifier. This functions, because the coupling portion of the plate tank coil is then coupled to a short-circuited coil. With the aerial coupler now de-tuned by the shorting switch, the coefficient of coupling between the two circuits is very much reduced, even though the coupling link has not been moved. There will be only a relatively small circulating current in the shorted aerial coil, so that the losses in this coil will be quite small. This is the same thing as saying that the plate tank circuit now works unloaded, so that it can be tuned accurately. Very little reactance will be coupled into the tank circuit from the aerial coupler under these conditions, so that the tuning accuracy will be very small. In practice it will be so slight as to be quite unnoticeable, when the load is re-coupled by releasing the push switch.

A point to note is that a relatively enormous inductance is needed to resonate the very small grid-plate capacity of the final at the operating frequency. The inductance has been made up in this case by two ZC1 Mark 1 aerial loading coils in series, together with a roller-type variable inductance to act as the neutralization control.

Another feature is the liberal use of parasitic suppressors, consisting of 100-ohm resistors shunted by small V.H.F. chokes.

In conclusion, we must express our thanks to Mr. Sutherland for sending us the details of his most interesting transmitter. The idea has so much to recommend it that we propose to do some experimental work with similar circuitry, but different valves that may be more readily available, to enable amateurs to use a similar scheme.

SPECIALISTS IN A
SPECIALIZED FIELD.
MR. SERVICEMAN.
Our Universal Coils, types 40 (Aer), 45 (R.F.) and 41 (Osc) will replace any damaged R.F. Coil.
Inductance Specialists
THE N.Z. HIGH FREQUENCY SPECIALISTS
207 TORRENSON QUAY, WELLINGTON, N.Z.
COILS, I.F. TRANSFORMERS H.F. CHOKES, B.F.O.'s DIALS, SCALES, COIL ASSEMBLIES, GANGS, BUILT-UP UNITS, ETC.

*Circuits for the Experimenter*

# CRYSTAL OSCILLATOR CIRCUITS

The importance of crystal oscillators in modern communications technique can hardly be over-estimated They are responsible for the frequency stability of almost every kind of radio transmitter in common use today and it is safe to say that without them, the tremendous advance that has taken place in radio communication over the last twenty years would hardly have been possible. Even in amateur transmitters, the crystal oscillator has a very important position, and although there is now a tendency for more very stable variable-frequency oscillators to come into use, the amateur movement has the crystal to thank for the advances in transmitting technique that have allowed such enormously increased activity on the relatively narrow amateur bands to take place.

The above remarks being true, it is surpising how little space is devoted in text books to the properties and working of crystal oscillators, and it is our guess that very many amateurs have only a hazy idea of

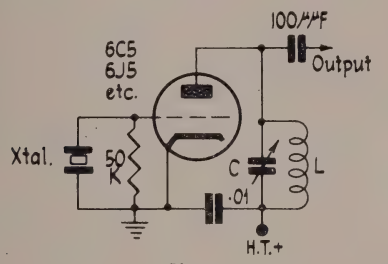


Fig. 1

how to get the best out of the crystals they possess. This short article certainly does not pretend to be a treatise on crystal oscillators, as the subject is a very large one, which appears to be studied in all its detail only by those specialists whose work is concerned with the more learned aspects of the subject. What we do hope to do, however, is to give an elementary idea of just what a crystal does in an oscillator, and to indicate which of the commonly used oscillator circuits are most suitable for the various types of crystal, and for the many different applications.

## THE CRYSTAL AS A TUNED CIRCUIT

One of the difficulties connected with crystal oscillator circuits is that the circuit diagram, using the conventional symbol for the crystal, gives no idea at all of how the crystal works electrically, and therefore an equally poor idea of how the circuit as a whole functions. For instance, take the simple crystal oscillator of Fig. 1. Most books airily explain that the crystal looks to the circuit like a very high-Q tuned circuit, so that this arrangement can be regarded very simply as an ordinary T.P. T.G. oscillator. This is all very well as far as it goes, but that is not very far, so let us see for a start if we can make a little more sense out of it than this.

First of all, what does the crystal do? And just what is the piezo-electric effect which allows it to act as though it were a circuit made up of inductance

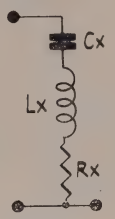


Fig. 2

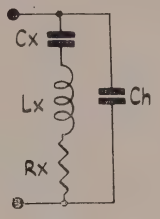


Fig. 3

and capacity? Well, the piezo-electric effect is one whereby if a crystal of a certain type is deformed in a certain way—bent in the cases of some, or squeezed in a particular way for others—it is found that an electrical potential is developed across certain faces of the crystal. If metal plates are placed near to these faces, the potential can actually be measured between them when the deformation takes place. Just how and why this behaviour occurs is hardly a fit subject for an article like this, and is in any case a matter related to the molecular structure of the crystals concerned, about which the present writer knows next to nothing. Suffice it to say that the effect occurs. What we are trying to do here is to see how it is made use of.

If instead of mechanically deforming the crystal, an electrical potential is applied to the previously-mentioned electrodes, it is found that the converse type of behaviour takes place, namely that the crystal becomes deformed. This deformation is very slight, because of the stiffness of the crystal. However, like all objects that can vibrate, the crystal has a natural vibration frequency; it can be likened, for example, to a metal bar clamped in a vice and struck with a hammer. It will vibrate at its natural frequency, and give off a sound of pitch corresponding to that frequency. If it is long and heavy, the pitch will be low, but if it is short and light, the frequency may be very high—even above the limit of audibility. The stiffness of, say, a quartz crystal is so great, that its natural vibration frequency is very high indeed. By suitably dimensioning the crystal, the frequency can correspond to a very high radio frequency, so that the vibration can certainly not be heard. If we feed to the electrodes of the crystal an alternating voltage corresponding to its natural vibration frequency, it will in fact vibrate at that frequency. What makes the crystal so useful in radio frequency oscillators is that (a) its natural vibration frequency can easily be made to come within the R.F. range and (b) its resonance is so sharp, that it is virtually impossible to make it vibrate at any frequency other than its natural one, which is almost solely fixed by its mechanical properties. By these we mean the manner in which it is cut from the original piece of quartz, and its dimensions. Since this article purports to deal with circuits rather than mechanisms, we

cannot devote space here to a description of the quartz crystal, and of the various crystal cuts that are made from it. We will merely state that there are very many different ways of cutting a "crystal" from a lump of crystalline quartz, that each method gives a crystal with different properties from all the others, and that the special properties of each type of cut make it specially suited to a specific range of applications.

Having made the point that the crystal is a resonant mechanical vibrator which can be excited into performing its vibration by means of an alternating voltage at its resonant frequency, we now come to the question of how this allows the crystal to act as though it were a combination of inductance and capacity. This is not very difficult when we remember that the piezo-electric effect is reversible, i.e., that if the crystal is set vibrating, it produces an alternating voltage across its own electrodes, and acts therefore as a generator. At frequencies far removed from resonance, the crystal in its holder is nothing more than a small condenser, with a capacity of a few picofarads. Thus, in an R.F. circuit, it will have a high impedance. However, at the resonant frequency, the vibration of the crystal produces voltage across its electrodes at that frequency, and this voltage is in the same polarity as the alternating voltage that is driving it into vibration. As a result, it becomes very easy for the driving voltage to pass current through the crystal, which looks then like a very low resistance. Since the vibration is a resonance phenomenon, it is logical to liken the crystal to a tuned circuit, containing inductance, capacity, and resistance, and because at resonance, the impedance is very low, the crystal can be represented as a series-tuned circuit, as in Fig. 2. This circuit can be called the equivalent circuit of the crystal.

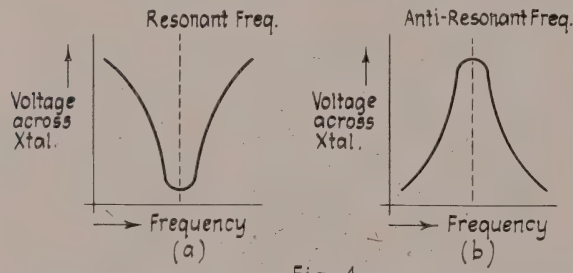


Fig. 4

Unfortunately, however, it is not complete, as it does not take into account the small capacity between the mounting plates, so that to give a true equivalent circuit, we should add this capacity as in Fig. 3. Now it is at this point that a slight complication enters, which many people find difficult. A circuit like Fig. 3 is one which has not one resonant frequency but two. Strictly speaking, one should be called a **resonant** frequency, and the other an **anti-resonant** frequency. Most people will recognize them better as **series-resonant,** and **parallel-resonant** frequencies. In this circuit, which type of resonance is actually in use in a given example, depends not on the crystal, since all of them have the two resonant frequencies, but on the circuit in which it is used. The two frequencies are very close together, but they are quite separate, for all that, and anyone who has accurate frequency-measuring equipment can prove this for himself by experiment. We are all familiar with the response curves of series and parallel-resonant circuits. These are like (a) and (b) in Fig. 4. When a voltage of variable frequency is applied to these two types of circuit, their responses are as shown. Now a circuit like that of Fig. 3 shows both these types of response, and has an overall response curve like that of Fig. 5. Also, the higher the Q of the tuned circuits, the steeper will the curves be, and the closer together will be the resonant dip of the series circuit, and the anti-resonant peak of the parallel circuit. And, just to emphasize the point, the frequency at which the crystal operates will depend on whether the circuit

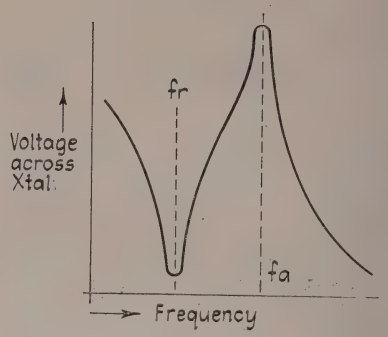


Fig. 5

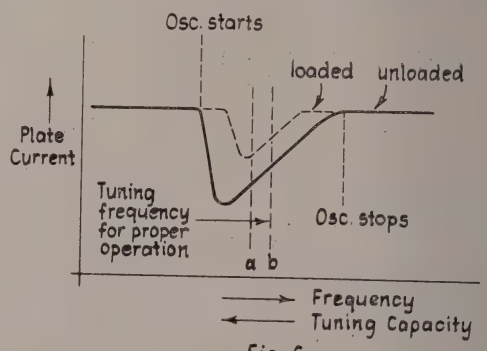


Fig. 6

it is in functions because it requires a series or a parallel-tuned circuit. If the former, the frequency will be very slightly lower than if the latter holds. Just as a matter of interest, it is possible from the behaviour of a crystal, and measurements taken on a circuit containing it, to work out the values of the components in the equivalent circuit. A typical crystal working at 5 mc/sec., could be found to have the same performance as an actual circuit, of the shape of Fig. 3, in which $L_x = 0.05$ Henries, $C_x = 0.02\mu$fd., and $r_x = 50$ ohms. Added to all this, the Q of the crystal circuit works out to 31,400! In order to emphasize how closely the two resonant frequencies correspond, it may be mentioned that in the crystal used as an example, the difference between the two frequencies would be between 100 and 200 c/sec., depending on the capacity of the mounting.

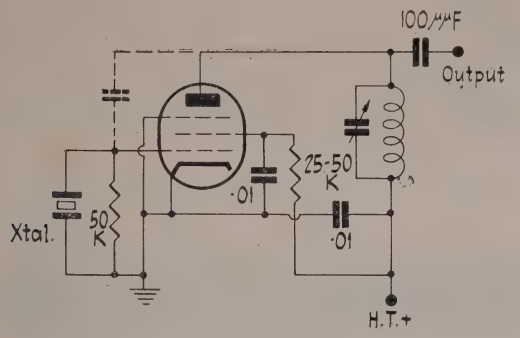



Fig. 7

## SOME OSCILLATOR CIRCUITS

The simplest possible oscillator circuit is the simple triode one of Fig. 1. This really is an ordinary tuned-plate-tuned-grid oscillator, in which the tuned circuit in the grid has been replaced by the crystal. For it to oscillate, the plate tank must be tuned to a slightly higher frequency than the grid circuit, otherwise the feed-back through the grid-plate capacity of the valve is in the wrong phase to produce regeneration. As the plate tank is turned through the crystal frequency, the plate current behaves as shown in Fig. 6. With the circuit not oscillating, the tube has no bias, and so the plate current assumes a very high value. As the capacity is decreased, the plate current takes a very sudden dip as the oscillation starts, and just after this, reaches a sharp minimum, at which maximum power output occurs. Unfortunately, the circuit cannot be set in this position, because it will not start positively, especially when loaded. As the capacity is reduced further, the plate current increases again, but much less rapidly, and the correct setting for operating the plate tuning is shown by the dotted lines. This is where the output is approximately 60% of the maximum output. The oscillator grid current can also be measured, and taken as a measure of the output. Operated with the plate tank tuned in this manner, starting is quite positive, and the crystal current is reasonably low. The dotted curve shows the behaviour of the plate current when the oscillator is fairly heavily loaded. This shows why the tuning must be off-set. It also shows that the range of permissable tuning is less when the oscillator is loaded than when it is running without load.

An important feature of this oscillator circuit is that the excitation, and therefore **the crystal current, is less when the circuit is loaded than when it is not.** This is important because if the excitation is too strong, the crystal may be fractured, because it is made to vibrate too strongly. It can be seen therefore, that the manner in which the excitation varies under different operating conditions is an important piece of knowledge for successfully operating any crystal circuit.

The main difficulty about this circuit is that the only way of varying the excitation is by altering either the plate voltage or the loading, and many triode crystal oscillators have broken their crystals because it was not appreciated that especially with modern midget crystals, **this circuit cannot be operated with complete safety at plate voltages over 100 to 150.** Thus, in spite of its simplicity, added to the fact that it cannot act as a frequency multiplier, this circuit is seldom used.

A similar circuit using a pentode is shown in Fig. 7. The behaviour of the circuit is very similar to that of the triode circuit, except that as the grid-plate capacity is much smaller than in the triode case, it is difficult to over-excite the circuit. Indeed, with very well shielded pentodes like the 6K7, 6AC7, EF50, etc., it is often found that extra capacity, as shown dotted on the circuit, has to be added in order to make the circuit oscillate at all. With power tubes like the 6F6, 6V6, EL41, EL33, etc., it will be found that the circuit behaves very much like the triode one.

In all cases, whether the valve is a triode, tetrode, or pentode, the excitation is varied when the plate tuning is altered, but it is safer to limit the plate voltage to a value that will not allow the crystal current to become excessive under any conditions. With both the Fig. 1 and Fig. 7 circuits, the crystal excitation is greatest when the plate tank is unloaded so it is always a good precaution to have the filament or heater of the next valve switched on at the same time as the oscillator, so that the following tube can load the oscillator as soon as it starts working. With the tetrode and pentode circuits, the screen-grid voltage is more critical than the plate voltage, and should be kept to 150 volts or lower with the modern small crystals. With the larger pre-war types, the screen voltage can go up to 200 or 250. The plate voltage for tetrodes and pentodes can be as high as 400 for the large crystals, but should be kept down to a maximum of 300 for the smaller types.

(To be continued)

---

# A Unique Auto Radio Installation for the Basrah Petroleum Company

To link the Makinah headquarters of the Basrah Petroleum Co. Ltd., with the Zubair oil field in one direction and the loading port of Fao in the other, Automatic Telephone and Electric Co. Ltd., have installed a multi-channel v.h.f. radio communication network incorporating inter-dialling and teleprinter facilities.

Fully automatic exchanges at Zubair, Makinah and Fao are linked together by three direct and three indirect telephony channels. Duplex telegraph working is also provided, together with through working magneto telephone and teleprinter circuits, to control oil pumping operations over the 74 miles of pipe line connecting Zubair and Fao.

Junction dialling is effected by A.T.E., v.f. dialling equipment pulsing a single audio frequency of 2520 c/s.

Special features are automatic change-over to stand-by transmitter and receiver bays in the event of failure of working equipment, and unattended v.h.f. radio repeater station at Seebah which provides remote alarm indications at the Makinah headquarters. Stand-by diesel generators, which automatically start in the event of mains failure, are provided at each location.

The decision to use v.h.f. radio, rather than line routes, was made in view of the natural difficulties presented by the terrain which ranges from hard rocky desert to vast salty marshes inundated for considerable periods each year. The hazards, to a pole and line route, of extremes of heat, humidity and storm, and the risk of accidental or malicious damage to overhead lines were also given due consideration.

The successful installation of this v.h.f. auto-radio system in the Basrah oil field represents a major technical advance directly assisting the production of world oil supplies.

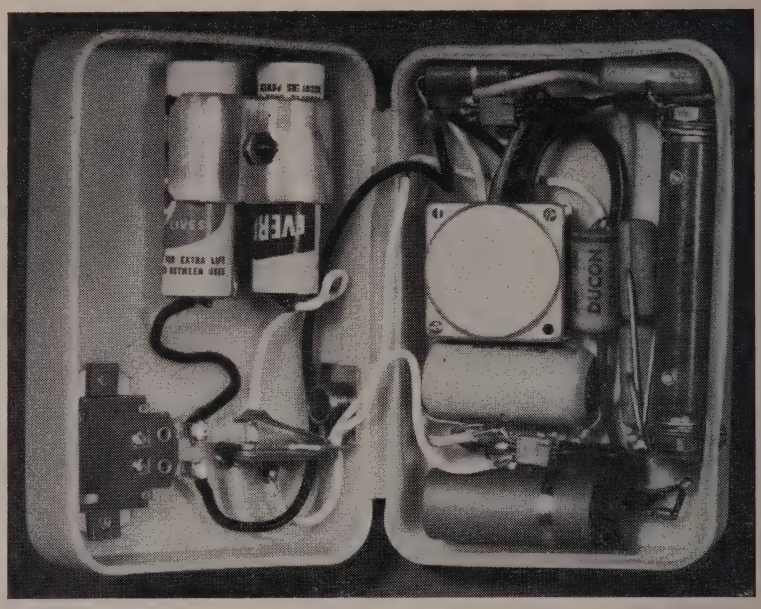
# The PHILIPS Experimenter

An advertisement of Philips Electrical Industries of N.Z., Ltd.

## No. 102: A Transistorized Geiger Counter for Prospecting Use

### INTRODUCTION

In the last several Experimenters, we have dealt in some detail with a new and most useful class of transistor circuit, namely the D.C. converter. Several possible uses for these were suggested, but a very topical one that has not so far been touched on is the subject of this article. For prospecting for radioactive minerals, a Geiger counter is a necessity, but many of the instruments that have been produced for this purpose have been too bulky, too heavy, or both. In addition, they have used quite heavy dry batteries, so that the prospector, who has to carry everything he needs over sometimes very rough, inaccessible country, is burdened not only with the instrument itself, but also with spare batteries. As a result, any Geiger counter that is really small and light, and which does not require a large weight of replacement batteries to be carried, should be of immense value to the prospector, amateur or professional.



*View of the complete counter with the lid open. The switch, battery, and 'phone jack are in the lid. Note that only one 16HT20 rectifier can be seen, the other being directly underneath it.*

The instrument described in this article measures only 4½ in. x 2¾ in. x 1½ in., and weighs only eight ounces, complete with its batteries, which are housed inside it. Battery power is obtained from the two pen cells, weighing ¾ ounce each, so that several months of normal operation can be obtained from a few shillings worth of cells, weighing only a few ounces.

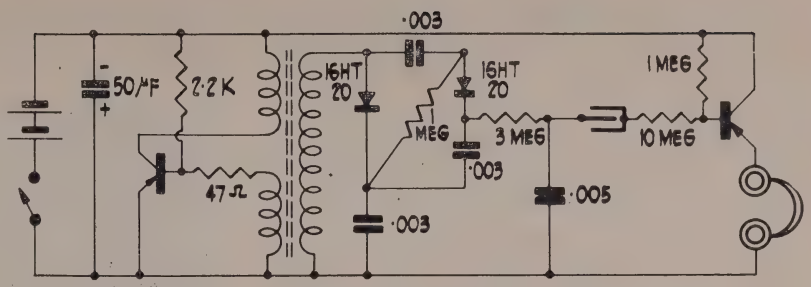
This achievement would not have been possible but for the existence of a miniature Philips Geiger counter tube, type 18503. This is only two inches long, and just over half an inch in diameter. Also important is the fact that it needs only a moderately high voltage to make it work, as this also enables a compact high-voltage generator to be used. The high-voltage generator consists of a transistor D.C. converter, which provides the necessary 500 volts at the expenditure of only 17 ma. from the 3-volt battery which powers the whole unit. From this it can be appreciated that without the D.C. converter technique, using transistors, a complete instrument as small and light as this one is would still not be a possibility.

A second transistor is used as an audio amplifier, amplifying the clicks made by the Geiger tube each time it detects a particle of radiation, to a level suitable for operating an ordinary pair of high-impedance headphones.

### THE H.T. SUPPLY CIRCUIT

Those who have read our recent series of articles on D.C. converters will recognise the major part of the circuit as being one of these, in which a voltage-doubler rectifier system provides the D.C. output which is fed to the anode of the Geiger tube. The oscillator portion of the circuit is identical in form with the arrangements that have already been described. There are, however, two features that deserve special mention here. The first is the connection of a 2.2k resistor from the base to the negative terminal of the battery. This, in conjunction with the base resistor of 47 ohms, serves to place a small negative potential on the base electrode, thus biasing the transistor slightly in the conducting direction. The purpose of this bias is to ensure that the oscillator is self-starting. Without it, some transistors may not start oscillating when the battery voltage is applied as a small positive potential can build up on the base, thus cutting off the collector current. The second point is the connection of a 50 μfd. low-voltage electrolytic condenser across the battery terminals. The reason for this is that the peak current drawn by

the collector is several times higher than the average current, and in the absence of the condenser, the voltage drop in the internal resistance of the battery may prevent the collector from drawing the necessary peak current, and therefore from developing the required output voltage, without increasing the average collector current, and therefore lowering the efficiency. When the condenser is there, the high peak current is drawn from the condenser, which is able to recharge during the periods of low collector current; in this way, the efficiency is kept high.




*Circuit of the counter. The Geiger tube is a Philips 18503, and the transistors are both Philips OC70.*

The use of a voltage doubling circuit on the secondary side enables a smaller transformer to be used than would otherwise be the case, because otherwise, the turns ratio of the transformer would be very high indeed, and might necessitate a size larger in pot cores. In the voltage doubler circuit, the first rectifier charges up its condenser up to almost the full peak voltage of the waveform provided by the transformer. The junction between this rectifier and its condenser, which acts in a similar way to the input condenser of any condenser-input filter system, now serves as the reference potential for the second rectifier. The 1 Meg. resistor allows the plate of the second diode to be at a positive potential equal to the D.C. voltage developed by the first rectifier, while the condenser coupling the second diode to the upper end of the transformer allows the A.C. transformer voltage still to be applied to this diode, in spite of its whole circuit being, as it were, "up in the air". The second rectifier and its series condenser then act in the usual way, rectifying the A.C. voltage, and adding it to the voltage which already exists in this part of the circuit, owing to the action of the first rectifier. Thus, at the junction of the second rectifier and what may be regarded as its own input condenser, we find a D.C. potential almost equal to twice that developed by a simple half-wave rectifier.

From the output point on the rectifier circuit, a 10 Meg. resistor feeds the D.C. potential of some 500 volts, to the anode of the Geiger tube which functions in the following manner. In the absence of any radiation, the gas inside the tube acts as an insulator, and no current is passed by the tube. When a radiation particle passes through the tube, a small portion of the gas is ionized, and therefore becomes conducting. The ions, which are electrically charged molecules of gas, move very swiftly under the influence of the electric field provided by the 500 volts across the tube, and in colliding with other gas molecules, ionize them also. A regenerative action takes place very quickly, and enough gas in the tube becomes ionized to enable a current to flow through it. This current is limited by the resistance in series with the tube, and by means of a quenching action, caused by some special gas molecules, purposely included in the filling of the tube, is caused to come to a fairly sudden end, so that the net result of a particle of radiation passing through the tube, is that a pulse of current is passed through the tube. One way of observing the presence of this current is simply to place a pair of headphones in series with the tube and its supply, so that each pulse passes also through the phones, and is heard as a click. If a very sensitive pair of phones is used, this scheme works quite well, and gives a perfectly audible, and even loud signal every time the Geiger tube signals the passage of a particle of radiation. However, most phones are not sensitive enough for this without some amplification, so that here, we have replaced the phones with the input circuit of a transistor amplifier, with the phones in the output circuit. This ensures that there will always be a loud enough signal to work even an insensitive pair of phones, and as the transistor amplifier draws only 1 ma. from the 3-volt battery, it can well be afforded. The amplifier is used in a grounded-collector circuit, with the headphones shunted across a 1000 ohm load resistor in the emitter circuit. This arrangement has many features in common with the cathode follower valve circuit, among them being high input impedance. In the transistor case, the input impedance is still low compared with that of a valve, but it is much higher than that of the other two transistor connections. The purpose of using it here is to ensure that the greatest possible voltage is developed across the input circuit of the transistor. In this way, the transistor is made to "bottom" during each pulse, so that all pulses are identical in shape, and in their effect on the phones. In use, one estimates mentally the rate of arrival of the pulses, and since the background count, or the rate of arrival of pulses in the absence of any radio-active material, is very small, being on the average only 20 per minute, it is a simple matter to tell when even a weak source of radiation is affecting the Geiger tube.

## CONSTRUCTION

The construction is well illustrated by the photograph, as almost all of the parts can be seen. The main part of the circuit is built into the box proper, while the lid holds the on/off switch, the 'phone jack, and the 3-volt battery. The Geiger tube is the cylindrical object at one end of the box. Next to it is the amplifier transistor, after which can be seen the electrolytic condenser and the transformer in the pot core. At the far end (the back in the photograph) is the oscillator transistor. The H.T. rectifier circuit is at the right in the photograph, the two metal rectifiers being mounted one above the other.

These rectifiers are made by Westinghouse, and their type number is 16HT20. They are about 2¾ in. long, including the screw terminals at the ends.

(To be concluded)

# A New High-Frequency Point Contact Transistor

The General Electric Company Ltd. has developed a new high frequency germanium point contact transistor known as type EW51. Its main value is in pulse circuits (e.g. amplifying, forming and shaping of pulses) and it is therefore of considerable importance in the field of digital computers. Used as a pulse amplifier its speed of response is such that, if the rise time of the input waveform is 0.05 microsecond, the rise time of the output waveform is less than 0.15 microsecond (usually less than 0.10 microsecond).

If the input waveform does not cause the transistor to "bottom" (a condition of high collector current, low collector voltage, in which further increase in the amplitude of the input signal does not increase the amplitude of the output signal) the fall time of the output waveform will be approximately equal to the rise time. If bottoming occurs the fall time will be increased because of the "hole storage" effect; the actual increase will depend on the degree of bottoming and the duration of the pulse.

In the typical case the current gain (alpha) falls to 0.7 of its low frequency value at a frequency of 4 Mc/s. This means that it can be used in high frequency amplifier circuits when a low noise factor is not the main requirement (a typical noise factor value, measured at a frequency of 1 Mc/s, is 20 db). The low values of the interelectrode capacitances ($1 - 2\,p_F$) is also an important feature.

To obtain this performance the spacing between the metal whiskers at their points of contact on the germanium surface is extremely small (approximately 0.001 in.). This has been achieved by paying particular attention to the mechanical construction of the transistor; as a result it can withstand considerable mechanical shock and vibration and can also be stored at temperatures of up to 70°C. without change in characteristics.

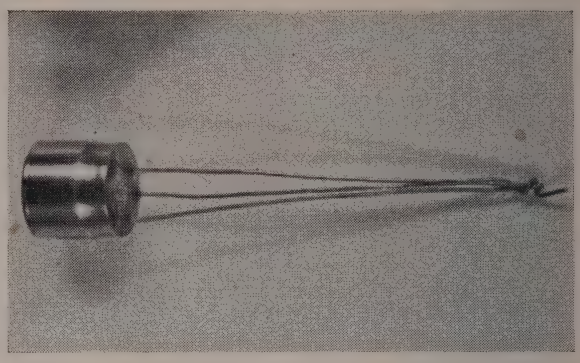
The transistor is heremetically sealed in a metal container, measuring $\frac{3}{8}$ in. in diameter and $\frac{3}{8}$ in. in length. It has successfully withstood a test in which it was cycled daily for 84 days to an elevated temperature in a very humid atmosphere.

It has a number of interesting electrical features. Thus it "bottoms" at a collector voltage of the order of 1 volt; this is advantageous in circuits operated from a low D.C. supply voltage. The "off" collector current (i.e. the current that flows at a given collector voltage when the emitter current is zero), although slightly higher than in some types of point contact transistors, is almost independent of temperature over the allowed range of operating ambient temperature. Increasing the ambient temperature from 20°C. to 50°C. causes the "off" collector current to increase by only about 10%.

### Ratings and Characteristics

(at an ambient temperature of 20°)

The maximum allowable values of collector voltage, collector current and collector dissipation are — 20 volts, — 15 milliamps and 100 milliwatts respectively. Typical values of "off" collector current, $I_{co}$ (with emitter current zero) are — 20 volts respectively. At — 10 volts the transistor is specified to have a value of $I_{co}$ less than —2.5 ma.



*The new G.E.C. high frequency point contact germanium transistor, type EW51, which is designed for use in pulse circuits such as those employed in digital computer equipment. It is here shown full-scale.*

When the emitter and collector currents are 3 ma and — 5.5 ma respectively the collector voltage is less than — 1.3 volts; in a typical case the value of this collector "knee" voltage is 0.8 volts.

At a collector voltage of — 5 volts when the emitter current is changed from 0 to +1 ma the change in collector current corresponds to an average value of current gain, alpha, of 3 in a typical case. The transistor is specified to have a value of alpha, measured in this way, of not less than 2. When the emitter current is changed from +1 ma to +2 ma a typical transistor shows an alpha of 2.

### Maximum Temperatures

Maximum storage temperature 70°C.

Maximum operating ambient temperature 50°C. (Collector dissipation must not exceed 30 milliwatts).

### Pulse Performance

When a pulse, having an amplitude of 3 ma, a duration of 0.5 microsecond and rise and fall times of 0.05 microsecond, is applied to the emitter of a transistor with a collector load resistance of 75 ohms and a collector supply voltage of — 15 volts the rise and fall times of the observed collector current pulse are less than 0.15 microsecond. (This test is normally done with a small amount of positive static emitter current (+0.3 m.a.) so that the input resistance of the transistor is not excessively high at the commencement of the pulse). Thus the transistor is suitable for amplifying pulses of even as short as 0.5 microsecond duration.

If the collector load is increased, in the above test, to a value of 1500 ohms and the amplitude of the input pulse to +10 ma. the rise and fall times of the collector current pulse are less than 0.15 microsecond and 1.5 microsecond respectively. Under this test condition the transistor is "bottomed" with both emitter and collector currents approximately +10 ma and — 10 ma respectively.

# RECORD TALK

by JOHN GRAY

The first all-New Zealand LP comes, appropriately enough, from Tanza. It is called "South Sea Rhythm" (ZLP 001) and features Bill Wolfgramme's Islanders, who are joined by Daphne Walker in four of the nine items. The disc is nicely packaged complete with polythene bag, and is encouraging evidence of what can be achieved here, even though we may reflect that the appearance of our first disc nearly six years after LP hit the English market is none too soon! On 78, the Walker-Wolfgramme combination are heard in "Kapuana" and "Planting Rice" (Z265) and I hope your copy is a better pressing than the one I sampled. Better in every way is a new Stardusters coupling on Z264, the main item being "Black Denim Trousers and Motor Cycle Boots", a ditty with a faint flavour of "Riders in the Sky", and one which the Traffic Department will warmly approve, I imagine. The backing is "Moments to Remember", another tune very much in the air just now. A further Stardusters disc features "Sixteen Tons" (Z263) a rather droll American work song which has achieved enormous popularity. Its backing is "Only You".

The inexhaustible Bing Crosby must have more records to his credit than any other popular singer, and Festival have revived some of his successes on an LP called "Song Hits from Broadway Shows" (CFR10-514). Numbers from Oklahoma" and "Carousel" share the disc with two from the lesser known "Bloomer Girl". Festival also have a pleasing Latin-American disc by Roberto Inglez issued as "Tropical Fiesta" (CFR10-768). Unless I am mistaken, this has reached Festival through American Decca, who got it from English Parlophone, a fascinating demonstration of the international scope of the record business. To raise a laugh—and there is still too little humour available on modern records—you should hear CFR10-761, "The Laugh of the Party", featuring single items by a number of America's top humorists, Joey Adams, Al Kelly and others. At least, sample "How Now? Brown Cow". There is a "Power House Dance Party" by Grady Martin's Slue Foot Five on CFR10-764, and a more genteel kind of dance party is contained in the Los Angeles Philharmonic's record of well known Tchaikovsky waltzes (CFR10-763). The classical release has two of the Beethoven violin sonatas series played by Joseph Fuchs and Arthur Balsam —the E flat from opus 12 and the A major from opus 30. This series has also been appearing for H.M.V. under the English Brunswick label.

Philips have "Moments to Remember" in the hit parade version by the Four Lads, coupled with "Dream On, My Love, Dream On" (B21711) and "Suddenly There's a Valley" seems to have been written for the voice of Jo Stafford (B21704). Henri Leca's piano playing in the Latin American vein has long been featured in Continental catalogues, and Philips have done well to make him known here. His latest, of "Extase" and "Cross Hands Boogie" should please everyone (P27182). The arrival of more Gospel Singers points to a continuing trend in popular music, and perhaps there is more to be said for the genuine article than for "hit parade" tunes with a religious slant. On B24578 the Johnson Family Singers are heard in "The Old Rugged Cross" and "Farther Along". A record entitled "Let's Tap Dance", played by Tony Mottola and his orchestra (D21735) is put out as a children's disc, but possibly its interest will not be confined there. Teenagers will, in addition, welcome the Blue Sioux City Five in "Sentimental Journey" on B21745.

Mercury have a top hill billy group, the Carlisles, in "The Mainest Thing" and "Busy Body Boogie" (M4150) and two numbers from Sarah Vaughan "Johnny Be Smart" and "Hey Naughty Papa" (M4155). These are the only two new releases from this source at the time of writing, but H.M.V. are off to a flying start this year. In addition to the newer Capitol releases, they have made available several of the older ones, and on their established labels there is a great deal of topical interest. On HR10146 Homer and Jethro have their "go" at "The Yellow Rose of Texas" with the usual devastating results, following it up with a hilarious item called "Listen to the Gooney Bird". Hill Billy fans will warm to the latest from Hank Snow "I'm Moving On" and "With This Ring" (HR10153). Boyd Bennett and his Rockets have successfully adpoted the style of another very famous group and are probably wise to cash in on the current boom. Their titles are "Tennessee Rock and Roll" and another, spelt simply "Oo-Oo-Oo" (NZP20). Less hectic, more melodious, are a whole batch of issues by "middle of the road" artists and combinations, all of which can be recommended as good specimens of their kind. For harmonica fans, there is Leo Diamond's coupling of "Destiny" and a theme from the film "Female on the Beach" in which the player is backed by Henri Rene's Orchestra (HR10134). For those who thrill to the soaring trumpet of Eddie Calvert, who was number one among popular artists in England last year, there are two discs, "Spellbound" and "Love is a Many Splendoured Thing" on DB3659, and "John and Julie" backed by "Heart of the Sunset" on DB3624. Irish sentiment is well to the fore in Joseph Locke's "Galway Bay" and "Macushla" (DB2447), and in this connection we might mention two of Decca's Irish series as sung by the popular Patrick O'Hagan. They are "Little Old Mud Cabin" and "An Irish Girl for Me" (DEC101) and "Cottage by the Sea", also "The Whistling Gypsy" (DEC102). For rollicking gaiety, try the Big Ben Banjo Band's disc of "Let's Get Together Again" on Columbia, DB3676.

The H.M.V. group of labels have produced a further crop of light LPs. Eartha Kitt, the fascinating singer of sophisticated trifles, turns up again on DLP1087 which is entitled "Down to Eartha". A whimsical ditty, "The Day the Circus Left Town", the wicked lament "The Heel", and ten other items make this an outing for Miss Kitt's admirers. Recent shows are represented by discs of "The Boy Friend", a musical at present running in Sydney (DLP1078), a selection from the amusing Jack Buchanan film "As Long as They're Happy" (DLPC1) and Bob Hope's "Seven Little Foys" (DLP1088). The older generation will be pleased to see Sir Harry Lauder's name. He comes to life again on DLP1089 with all the favourites from "Roaming in the Gloaming" to "The Waggle o' the Kilt". Another Glen Miller concert is on DLP1081. Columbia offers Josephine Baker on 33CS2, and several of their best numbers are gathered on to LP by such as Eddie Calvert (on 33S1071, under the title of "Easy to Love"), and Ray Martin's Orchestra (33S1072, called "Isn't It Romantic?"). M.G.M. has numbers from "Annie Get Your Gun" by the film cast (MGMCD 1) and Gene Kelly sings on D133. From Decca, we have their "Traditional Jazz Scene, 1955" on LK4100, an extensive mambo collection from Edmundo Ros (LK4103) and no fewer than fourteen tunes done in distinctive style by Stanley Black on LK4106.

It might with some truth be claimed that virtually all the great music of the world has now been recorded, but one achievement seems thus far to have defied everybody—the production of a complete, integral set of Wagner's "Ring". The problem is not so much that of finding a cast, for, after all, the mighty work is now performed annually at Bayreuth, Covent Garden and Munich, to specify only three places. The difficulty seems to lie in assembling a cast who can be kept together for the time required to complete the job, and, even more difficult, a cast who are all free to record for the one company. It is an open secret that a complete set which Decca made from performances at the 1951 Bayreuth Festival was consigned to oblivion because one of the Rhinemaidens had an exclusive contract with a rival concern. However, a start has at least been made with the new H.M.V. issue of "Die Walkure" (ALP1257-61), the first "Ring" opera ever to be recorded uncut, though there have been, in the past, memorable issues of single acts from it. This set was made in Vienna shortly before the death of Furtwangler, so perhaps it is too much to hope that he had completed the other three sections as well. People like me, with obstinate memories of the 1930s, would have liked Flagstad, Melchior and Lehmann—instead we get Modl, Suthaus and Rysanek, which is not quite the same thing. But Margaret Klose is still with us to sing Fricka, and Ferdinand Frantz makes a fine Wotan. "Die Walkure" has always been the public's favourite among the "Ring" operas and this well recorded set, with the Vienna Philharmonic Orchestra under a conductor of unimpeachable qualifications for the music, is emphatically worth your money.

From Wagner we move to his arch-rival and exact contemporary Verdi, with the first LP release here of one of the latter's richest works "Un Ballo in Maschera"—"A Masked Ball" (ALP 1252-4). This was the last of Toscanini's broadcast performances, made in New York early in 1954. Once again we have a blazing performance which brings out the extraordinary fire of the orchestral part. Toscanini never seems to have singers quite able to match his own genius, but Jan Peerce is in fine form and the maestro's consistent devotion to his favourite soprano, Herva Nelli, seems justified here. The Robert Shaw Chorale and NBC Symphony Orchestra are once again used, and the recording is as good as any Toscanini has had. This comparatively unfamiliar opera is loaded with tunes of the type that inevitably made "Il Trovatore" a world wide success. Why "Ballo" has never been quite as popular is, to me, one of music's major puzzles. A third event from H.M.V. is "The Damnation of Faust" (ALP 1225-7), the wonderful Berlioz setting of the Faust legend which, although a concert work, is sometimes produced as an opera. Recorded in Boston under Charles Munch, it repeats the success he had with the same composer's "Romeo and Juliet", and he has a fine trio of principals in Suzanne Danco, David Poleri and Martial Singher. Shakespeare comes to life with "A Midsummer Night's Dream" on ALP1262-4; the Old Vic performance with Stanley Holloway, Moira Shearer and Robert Helpmann, on to

(Concluded on page 54)

# ELECTRICAL AND TRADE SECTION

## MAINTENANCE OF COOKERS

*(Reprinted from "The Practical Electricians' Pocket Book,1955")*

The neglect of regular maintenance of cookers usually shows itself as a breakdown when a meal is in the course of preparation. With proper attention the majority of faults developing can be noticed and counter-measures taken. The following survey of cooker components indicates the main points where maintenance can be satisfactorily carried out.

### FRAME AND BODYWORK

Where castings are used in the construction, the protection is by vitreous enamel and little maintenance is required other than cleaning. Sheet metal panels are protected by either vitreous enamel, for those parts which are subjected to extreme heat, and stove enamel for the remainder. The enamel on these parts is more readily damaged both by warping of the metal due to heat and by mechanical damage during general usage. Little can be done with this type of damage apart from the replacement of the affected part. When fitting, fibre washers should be used to prevent the enamel cracking.

The lagging of the oven is usually mineral wool, either in slab form or loose packed to a density of 12 lb. per cubic foot. Slag wool or metal foil is also used. To prevent moisture from the oven seeping into the lagging, a fire clay cement or gasket is used to seal the joint between the oven and door linings and frame member. This joint may be weakened by expansion and contraction of the metal. The lagging should be thoroughly dried before the joint is re-sealed. This fault can be detected if excess steaming occurs while the oven is in use, or if excessive heat is apparent on the outside panels of the cooker.

### BOILING PLATES AND GRILL

The plates normally used are of two distinct types: (a) the solid cast-iron plate, with element embedded in refractory cement as used for boiling plates, and with open spiral element for grills, and (b) the radiant type where the element is embedded in a refractory and the whole enclosed in a metal tube.

A solid boiling plate overheats when left switched on without a utensil upon it, and consequent failure occurs. Spillage from utensils and condensation due to humid atmosphere cause rust and scale to form, resulting in overheating and loss of efficiency. The surface and sides of plates can be protected against corrosion by application of a very thin film of vegetable oil (e.g. olive oil), well rubbed in with a cloth.

Radiant plate tubes have a high content of nickel to withstand the high surface temperature and do not retain moisture on their surface, consequently, there is less corrosion. The tubes should be kept clean from spillage, which may burn on and cause overheating. Radiant plate reflectors also act as a drip tray to prevent spillage falling into the hot cupboard. The efficiency of these plates will be maintained if the reflectors are kept clean and brightly polished.

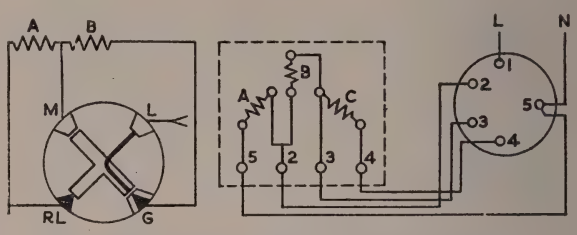



**Fig. 1 (left).—Three-heat series-parallel cooker switch: 1 off; 2 High, A B in shunt; 3 Med., A only; 4 Low, AB in series. For key to symbols, see page 109.**

**Fig. 2.—Four-heat five-position switch; 1 off; 2 High, ABC in shunt; 3 Med., AB in shunt; 4 Low, A only; 5 Simmer, ABC in series.**

The plug and socket connections of plates are "floating" to give self-aligning contact. An exception to this is the earth plug which is used to clamp the back plate and/or terminal cover in position. It is important to maintain this "float" and to see that both plugs and sockets are clean and free from blackening due to bad contact.

The dimensions of the plugs and sockets at the contact surface are made to close limits (i.e., 0.002 in.). It is therefore important not to use a severe abrasive for cleaning, otherwise the contact will be impaired.

Brass screws should be used in cast iron threads for the levelling of plates to prevent the "seizing" of the adjusting screws which results from corrosion. The recommended height of plate surface above the hob top is the thickness of a penny. This ensures that utensils make proper contact with the plates consistent with elimination of tipping of the utensils. The majority of cookers are fitted with boiling plates and grills designed for interchangeability, in accordance with E.D.A. standards, as between plates of different manufacture.

### SWITCHES

Control switches for the various circuits of the cooker are of the following types: **rotary** for all circuits, **simmerstats** for boiling plates and grill boilers, and **thermostats** for ovens.

Rotary switches may be of the simple on/off type or may be multi-positioned to give a wide variation of heat control. They may also be either single or double pole. Owing to the arduous duty, most faults are due to burning of the contacts or the "sticking" of the movement because of contacts becoming distorted. Little can be done on site to these faulty switches and they should be replaced. A sluggish mechanism can sometimes be improved by a very small quantity of oil applied to the spring and spindle, but oil should not be applied to the contacts as this will cause dust to accumulate and damage the contact surfaces.

The majority of cookers are fitted with three-heat (four-position) rotary switches giving High, Medium, Low, and Off positions. The connections are as shown in Fig. 1.

The "Simmering" or very low heat position on hotplates is obtained by using three elements controlled by a four-heat (five-position) switch, see Fig. 2.

## THE SIMMERSTAT

The Simmerstat is an "electric tap"; it is a unit that opens and closes a snap-action switch, the control knob determining the proportion of time "on" to time "off". In this way the average power input to a hotplate or other heater can be regulated. A schematic diagram is given in Fig. 3 and it will be seen that the snap-action switch is operated by a lever "driven" by a heated bimetal strip. The distance the strip must travel to operate the switch and hence the frequency of operation, is determined by a cam coupled to the control knob.

The switch automatically compensates for fluctuations up to V. ± 15% in mains voltage and also for variations of temperature in the switch itself. Able to replace the normal three-or-four-heat switch the Simmerstat measures 2¼ in. x 2¼ in. x 2 15/16 in. overall within the cooker switch compartment. There are two types: the TYC 2.5 kW rated at 250V. A.C. or 2 kW. at 110V. A.C. and the TYK for 5 kW. at 250 A.C. The latter incorporates a second switch that closes in the "Full" position, to allow the use of both windings of a two-circuit plate for quick boiling, reverting to one circuit only for simmering. Each switch must not be loaded at more than 2.5 kW. Connections for both types of Simmerstat are shown in Fig. 6.

## SIMMERSTAT SERVICE

To check if bimetal winding is open circuit, turn knob to "Full", remove cover, connect supply to terminals RL and G. in 10–15 minutes the bimetal should expand so that the distance between the compensating and operating bimetal has increased by approximately 1/16 in. Alternatively, measure the resistance of the winding which should be within these limits: 110V. 1,000–1,300 ohms; 200–250V. 5,500–6,500 ohms; 380V. 16,500–18,500 ohms.

## GENERAL INSPECTION

Inspect the Simmerstat for cleanliness. Remove any deposits which may have accumulated during use. (During this and subsequent operations, extreme care must be taken to avoid damage to the bimetal heater winding). Check that the screws holding the three terminal pillars are tight and that the contact pillar and switch bracket cannot be moved sideways by reasonable pressure applied through the thumb. Check also that the large nut which fastens the cam spindle bush in the Simmerstat is tight.

The steel block to which the operating and compensating bimetals are welded should be free on its pillar. Check this by first holding the Simmerstat with the spindle pointing downwards and then inverting the Simmerstat, i.e., turning it through 180°. When the Simmerstat is inverted, the bimetal assembly should fall freely under its own weight along the pillar to the extent of the available clearance. For this check, the knob must be in the "Full" position.

On inspection of the silver contacts of the microswitch after some months of service, it will be found

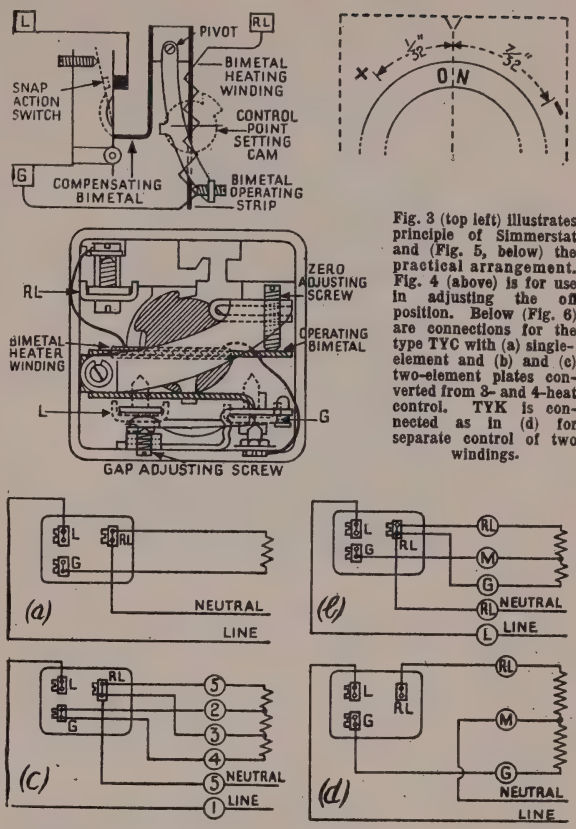



**Fig. 3 (top left) illustrates principle of Simmerstat and (Fig. 5, below) the practical arrangement. Fig. 4 (above) is for use in adjusting the off position. Below (Fig. 6) are connections for the type TYC with (a) single-element and (b) and (c) two-element plates converted from 3- and 4-heat control. TYK is connected as in (d) for separate control of two windings.**

that the surfaces of both are regularly pitted over an area which may vary from 1/32 in. in diameter to ⅛ in. in diameter, according to the length of service. This is a normal condition providing the pitting is not so serious that the contact gap has been decreased or increased outside the limits mentioned below. If the pitting is fairly heavy, it is advisable to clean the contacts before re-adjusting the contact gap, and this should be done in the manner described below. Check that the two legs of the microswitch leaf spring are fitted in the bottom of the V-groove in the bracket and that the ends of the legs are parallel with the line of the bottom of the Vee. The switch should not be twisted.

If it is necessary to clean the contacts, the gap setting screw should be turned back to widen the gap sufficiently to permit a small file to be used on each contact surface in turn. Under no circumstances should emery paper or polishing fluid be used. The contacts should be filed until all evidence of pitting has been removed. It is not necessary to burnish the contacts as a file finish is most suitable for a switch of this current rating. After setting or cleaning the contacts, the gap should be adjusted by means of the setting screws so that it is between 0.009 in. and 0.0011 in. Standard pattern feeler gauges may be used for the measurement, but care must be taken to ensure that, when setting the gap, no force is necessary to insert the feeler in the gap; otherwise the terminal pillars may be forced apart, thus making

the gap appear larger than it is.

If the contacts are found to be in a good condition, it is advisable to check the gap before touching the adjusting screw, as no adjustment may be necessary.

After checking the above-mentioned points, test for satisfactory operation of the switch by turning the knob to "Full" position and operating the switch by pressing on the bimetal with thumb or finger. The switch should snap open or shut with a sharp click and there should be no evidence of sluggish action or slow make and break.

The zero setting may be checked as follows: (a) If the knob is turned to the "Off" position, it will be found that the centre of the word "Off" coincides approximately with a short line on the porcelain base. This line, which is formed as the dividing wall between two short V-grooves, is the zero mark to which the Simmerstat is set during manufacture. (b) Mark the knob with fine pencil lines as shown in Fig. 4, which shows an enlarged portion. (c) Turn the knob to the "Off" position and then rotate slowly to the "On" position. The switch should close between the two lines shown as + and — in Fig. 4. If the closing point lies outside these limits, the setting should be adjusted by means of the zero adjusting screw shown in Fig. 5.

If the setting is below the lower limit, i.e., nearer to the "Off" than it should be, the setting screw should be screwed further into the bracket and vice versa. During the adjustment, care must be taken to support the back of the bracket with a finger to ensure that the force of the screwdriver is not transmitted to the bimetal. Undue force applied to the bimetal may cause over-stressing, which will result in instability in service.

## THERMOSTATS

Thermostats for controlling oven elements are of two types, expanding stem and tube, or liquid filled tube. In both cases, expansion due to heat is transmitted to a pivot system in the head of the thermostat and operates the contacts by means of a high ratio lever. Rough handling will affect the sensitive adjustment of the pivot and contacts, with consequent alteration of the calibration. Oven thermostats are variable between 200°F. and 600°F. and, depending on the position of the tube in the oven, may be calibrated with an "offset temperature" of up to 50°F., between the centre oven temperature and that of the thermostat tube.

Calibration can be checked by means of a thermocouple or clinical type thermometer placed in the centre of the oven. Several cycles of operation of the thermostat should be allowed before completing any adjustment to the calibration to provide for the time-lag inherent in the attainment of a level temperature in the oven.

Failures in thermostats are, in the case of the stem type, bent tubes, burning of contacts due to faults on the oven elements and alteration in calibration due to slipping of the driving mechanism caused by lack of lubrication. In the case of the liquid type, troubles are leakages of the liquid from the tube and/or operating bellows in the thermostat head and the burning of the contacts.

The maintenance of thermostats involves dismantling the thermostat head for the replacement and adjustment of faulty components. Dust, particularly ferrous particles, will collect around the sensitive movement and magnet causing erratic operation of the thermostat. It is recommended, therefore, that this work should be carried out by the manufacturers.

## OVENS

Oven elements are designed to obtain a particular proportion of radiant heat to convected heat, and the aim of maintenance is to preserve this relationship. The replacement element spirals should be as near as possible to the original with regard to gauge of wire, the mandrel size and the spacing of the spiral. Tails, or end connections of spirals are reinforced by additional nichrome strands, any welding being made in an inert gas. On-site repairs, which involve shortening the spiral, should be rectified by fitting new spirals as soon as practicable. Semi-radiant tubular elements cannot be rewound and open circuited windings require a complete replacement.

The ventilation of an oven controls the heat distribution and is obtained in various ways, such as gaps in the top and bottom edges of the door or by vents in the oven door and in the back of the oven. The siting of the cooker in a kitchen is important and positions which allow cold draughts to impinge on the oven should be avoided as the heat distribution will be affected and condensation may take place.

Cleanliness and freedom from burnt-on grease are most important factors in the satisfactory operation of cookers; this applies particularly to the oven. The avoidance of over-temperature will keep an oven free from burnt grease; washing away grease from the oven interior while the cooker is still warm assists towards this end. Detergents and preparations having a soda base can be used successfully, the oven interior being finally cleaned with a damp cloth which has been rinsed in clean water. Preparations are available having a very strong soda content or which contain an abrasive material. These should be used with caution in order to avoid damage to the glaze on the vitreous enamel. The use of knife blades and scrapers should be avoided as they quickly damage the enamel.

## SAFETY

The proper earthing of the cooker body and component parts is extremely important and particular attention should be given to the points where earth wires are connected to enamelled metal; the enamel must be scraped away to obtain a clean contact. Close attention should also be given to the earth pins and sockets of all plug-in components as the contact may deteriorate through oxidation or ingress of dust and grease. Earth continuity can be checked with a flash-lamp battery and bulb, but the earth circuit must be capable of carrying the current necessary to blow the fuse protecting the circuit.

Cooker sub-circuit fuses should be correctly wired, the contacts kept clean and all connections made firm.

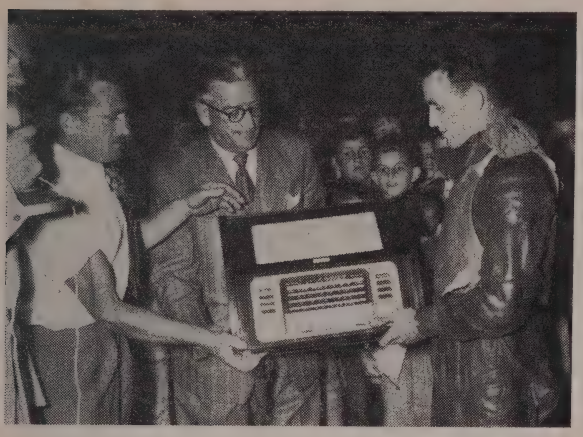
The provision of element guards on grill plates and oven elements prevents accidental contact with live metal and they should be adequately "earthed" and kept in a mechanically sound condition.

**Remember always to switch off at the main cooker control unit before commencing any cleaning or maintenance work.**

# TRADE WINDS

## AN ULTIMATE FOR A CHAMPION

The Western Springs Speedway in Auckland was the venue of the Ultimate-Ekco championship for motor-cycle broadsiders on Saturday, February 25, 1956.



*Mr. D. T. Clifton-Lewis presenting the prize to Mr. M. Neil.*

The event was run in eight heats and a final, and some of the world's best exponents of dirt track riding took the track to race for the prize, an Ultimate 6-valve bandspread mantel in a mahogany cabinet—itself a performer of championship class.

Riders of world renown and New Zealand's best battled in the heats providing the large crowd with speedy, spectacular racing. Fast times were the order of the night, and at the end of the heats the four riders with the most points were selected to contest the final.

Merv. Neil, a local rider of outstanding ability was the winner from a field that included two riders who were finalists in the 1955 World Championships. The winner richly deserved his trophy which was personally presented by Mr. D. T. Clifton-Lewis, the managing-director of Ultimate-Ekco (N.Z.) Co. Ltd., who donated the trophy.

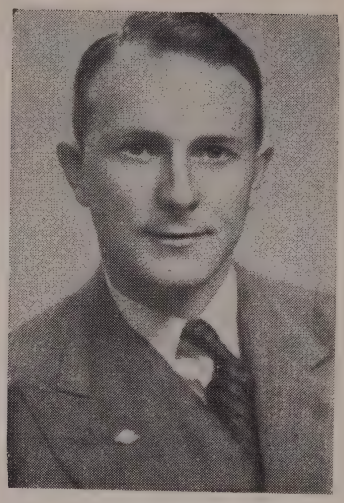
* * * *

## MR. W. L. YOUNG APPOINTED GENERAL MANAGER OF RADIO CORPORATION OF NEW ZEALAND LTD.

We are privileged to announce the appointment on 1st March, 1956, of Mr. William L. Young as General Manager of Radio Corporation of New Zealand Ltd.

Just under ten years ago, when he was associated with the launching of Russell Import Co. Ltd., neither his name nor that of the latter company were known to the Radio and Electrical Trade. Today, Russell Import and the service it offers to the trade from premises in Auckland, Wellington and Christchurch, is in no small measure due to the energy and capacity of that go-ahead personality, W. L. Young, who has been its first and only manager.

As General Manager of Radio Corporation of New Zealand Ltd., he will control not only the manufacturing activities of the organization, but also Columbus Radio Distribution, which is effected mainly through their chain of 33 Radio Centres from



*Mr. W. L. Young*

Whangarei to Invercargill. This is a unique coverage for New Zealand. Certain of Radio Corporation's manufactures, recordings in particular, are also available to the general trade, and therefore Mr. Young will continue to maintain his past associations.

A past president of the Wellington Radio Traders' Federation and executive member of the New Zealand Radio Traders' Federation, he has always taken a keen interest in the problems of the industry, and we know that he will carry the best wishes of all in his new position.

* * * *

## MR. P. PROCTOR APPOINTED MANAGER OF RUSSELL IMPORT CO. LTD.

Succeeding Mr. W. L. Young as Manager of Russell Import Co. Ltd., as from 1st March, is Mr. P. Proctor, formerly Sales Manager of that company.

Admitting that his first association with radio was an enforced one during war service as a pilot in the R.A.F. and later as an instructor in radio range, instrument landing systems and "ground controlled approach", Mr. Proctor subsequently had extensive experience in Britain during the immediate post-war years, with the development of the commercial use of radio telephone equipment. Joining Russell Import as South Island Field Representative in 1951, he was transferred to the position of sales manager, Wellington, earlier last year.

Needing no introduction to the South Island, Mr. Proctor's acquaintanceship in the North Island is steadily growing, and the good wishes of all go to him in his new position.

* * *

## NEWS FROM PHILIPS

Recent developments in Philips sales and service promotion have brought several executive changes. For the record they involve:

**Bill Farquharson**, manager of Philips Dunedin from 1948 to 1955, who became Wellington branch manager at the beginning of this year. Bill was a member of the R.N.Z.A.F. radar team during the war and has alternated between the technical and sales side of

radio since his college days in the South Island "long ago". Also a former radar man is

**Maurie Harding** who is now directing Philips sales promotional activities in New Zealand. He will be concerned with main products, initially concentrating on radioplayers and training of commercial staff. Lending support in the technical field,

**Johnnie Brown,** former Wellington Service Dept. manager, takes over the roving commission of service promotion. He will visit dealers to discuss and help with the ins and outs of instrumentation, measuring apparatus, and radioplayer performance. Johnnie will also be chatting about future television requirements.

**Eric Undrill,** Philips factory manager, left New Zealand in mid-March on a four-month trip to take in England, Europe, and the U.S.A. In Holland he will discuss plans for the new Naenae production centre now being built.

**Andy Buchanan** has joined the Electronic Development and Applications Co., to handle liaison between this company and Government Departments. Andy was previously Chief Radio Inspector for the Post Office.

## ANNUAL CONFERENCE OF THE N.Z. RADIO TRADERS' FEDERATION

The annual conference of the New Zealand Radio Traders' Federation will be held at Wanganui this year, from 19th to 21st May, inclusive, the first two days being devoted to social activities and the third day being reserved for business.

A large attendance of members is expected and the Wanganui Association is busy preparing for the entertainment of its guests with its typical warm-hearted hospitality.

## IMAREX LTD. APPOINTED NEW ZEALAND REPRESENTATIVES FOR ALFRED IMHOF LIMITED

Imarex Ltd., of P.O. Box 471, 75 Dominion Road, Auckland, announce their appointment as exclusive New Zealand representatives for the British firm of Alfred Imhof Ltd., world renowned for their famous instrument cases.

* * *

## AUCKLAND HI FI DEMONSTRATION

The attention that is now being paid to High Fidelity sound reproduction was shown by attendances at a series of demonstrations held recently in Auckland.

These demonstrations were held under the joint auspices of Pye Ltd. and Elco Radios Ltd., of Wyndham Street, Auckland. The sessions were very ably conducted by Jack Walch of Pye with the assistance of Fred Noad of the same company and Garth Wilson of Elco.

The Pye Black Box and the Pye PF91 Amplifier and PF91A Remote Control Unit were the instruments used for the demonstrations, and the widest possible variety of music was used.

The public were obviously very much impressed by the superb reproduction of these instruments, and Mr. Walch's explanatory remarks about Hi Fi in general and the instruments in particular added great interest to the demonstration.

Joint congratulations to Pye and Elco for pioneering in the Hi Fi field!

# A Practical Television Course through the Technical Correspondence School

For a full week in January last, thirteen keen radio servicemen gathered at the Seddon Memorial Technical College in Auckland to gain practical experience in television circuitry through a course conducted by Mr. R. B. Waddell of Auckland. Last year, these students studied the various circuits through a course conducted by the Technical Correspondence School, Wellington. During this week of practical work in Auckland, they built and tested many of these circuits, which are never used in sound receivers.

Great interest was displayed in the test equipment required for television receiver servicing, and instruments which appeared a maze of control knobs and switches seemingly too complicated ever to be mastered, were soon handled with the confidence of an expert.

Many questions were answered during the course, and two different receivers by well-known manufacturers were demonstrated. Here an opportunity was afforded for everyone to adjust the controls and watch the results on the test pattern. Students were given an introduction to alignment methods required for television receivers, and were able to handle the test equipment necessary to carry out such work. Lively discussion on special circuits was a feature of the course, and time was devoted to a consideration of the most suitable TV standards for this country, the future likely insufficiency of the 405 line system being pointed out.

*Students and Tutors who attended the TV course at the S.M.T.C.—Back row: B. L. Gulland, J. McMaster, B. F. Pepperell, T. B. Jones, J. R. Buchanan. Centre row: J. M. West, J. D. Huggard, A. R. Keatings, J. D. Little, F. O. Cleave. Front row: R. B. Waddell (lecturer); D. B. Raymond, K. G Duncanson (Technical Correspondence School), I. M. L. Grant, P. G. King.*

(Concluded at foot of page 43)

## NO. 8: SOME POINTS FOR AMATEUR DESIGNERS.

It has been our hope that this series of brief articles will have removed some of the popular misconceptions about dry batteries and their use, not only in torches and the like, but also in portable receivers. In this one, we would like to put forward some points which may assist those who design their own battery-operated equipment to obtain both optimum performance from the equipment, and maximum economy in the use of the batteries.

### (1) End-Point Voltage

Always attempt to design the equipment in such a way that satisfactory operation is obtained with the lowest possible battery voltage. To do this it is necessary to ensure that any portion of the circuit that can stop working altogether (e.g., an oscillator in a receiver or transmitter) when the battery voltage drops, will keep working even after the target end-point voltage has been reached. If anything can be done which will decrease the useful end-point voltage of the batteries by 0.1 volt per cell, the result will be a spectacular increase in the number of ampere-hours for use. For example, in portable equipment it is sometimes necessary to put up with a relatively high current drain, especially when the periods of use under this condition are short. This applies with particular force to portable transmitter-receivers, in which the current drawn on "Transmit" can be much greater than on "Receive". In one such case, where the current drawn from the B battery was 25 ma., the battery's useful output, measured in ampere-hours, was increased by a factor of 1.31, or 31% by re-designing the circuit so that the B battery could be used to an end-point of 15 volts per 22½ volt section, instead of to the original end-point of 17 volts per section.

### (2) Size of Cells Used

The best cell-size to use depends on a number of things, perhaps the most important being the current drawn, and the type of usage expected. For apparatus which is to be used regularly every day, it is important to design for as small a current drain as possible. When this has been done, the most important point is to use as large a cell size as possible.

For equipment which is to be used only sporadically, the situation can be quite different. For example, shelf-life of the batteries must be considered, for the smaller the cell size, the shorter the shelf-life. Thus for equipment which has only occasional use, and which draws very little current, there will be a minimum cell size which gives satisfactory operation over a long period. What this boils down to is that **it is always advisable to use at least one size larger than you think would be satisfactory.**

There is one notable exception to the rule above, and it can be a very important one. It is the case where, for technical reasons, it is not possible to use the batteries down to a very low end-point, and where usage is what may be described as "intermittent-continuous". That is to say, the equipment is turned on intermittently for short periods which extend without a long break for battery recuperation, over a relatively long period. This is the sort of use a portable transmitter might get while used on search and rescue operations. In such a case it may well be advantageous to use the smallest possible cell size, within reason, and to give the batteries a rest by using two sets alternately for, say, four-hour periods.

(To be continued)

---

Following a similar period of practical work next year, these students will be ready to take the examination in television servicing which already has received official overseas recognition.

After a most industrious and enthusiastic course, the students departed, resolved to build or buy at least one test instrument for the purpose of home experimentation.

Alas, the big question of a possible date for the introduction of television to this country still remains unanswered, but now there are a few more far-seeing souls preparing themselves for the advent of this service in New Zealand.

The Auckland Radio Traders' Association and many Auckland firms showed a keen interest in this course, and among the visitors to the class were:

Messrs. W. Murphy, assistant manager of Ultimate-Ekco Ltd., and president of the Auckland Radio Traders' Association; A. Staff, chief sales manager of Pye Ltd.; J. Wylie, design engineer for Beacon Ltd.; C. R. Peoples, Auckland representative for Standard Telephones and Cables Ltd., and ex-president of the Auckland Radio Traders' Association; and Mr. Power, staff engineer of the Auckland Post Office.

The two-year course in television theory conducted by the Technical Correspondence School, Wellington, is open to all radio servicemen who are unable to obtain such a course at their local Technical College.

---

## PRICE CORRECTIONS FOR ULTIMATE "ROYALIST" AND "CORONET"

Price alterations for the Ultimate "Royalist" and Ultimate "Coronet" sets came to hand too late for inclusion in our March issue.

The new price for the 6-valve Bandspread Lowboy radiogram, "Royalist" is now £105.

That for the 6-valve Bandspread, mantel "Coronet" is £42 10s.

# NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

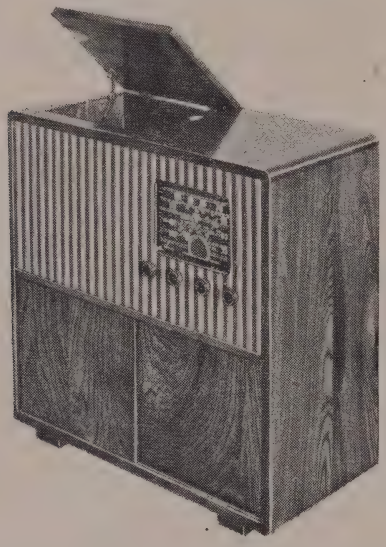
**This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars contact Advertising Manager, R. & E., Box 8022, Wellington.**

## "LA GLORIA" CONSOLES CREATE NEW MARKET

"La Gloria", the new, exciting radio now available in New Zealand, comes to you with everything that is latest and best, bringing a fresh and glorious meaning to radio listening and at prices which set a new standard of value. Sole New Zealand Distributors, Dominion Radio & Electrical Corporation Ltd., Huia Road, Otahuhu, P.O. Box 44, Otahuhu, Auckland.

* * *

### La Gloria "TRADITIONAL"



Featured above is the La Gloria "Traditional", a five-valve console radiogram with a quality English 3-speed automatic changer which takes all sizes of records.

La Gloria achieves wonderful tone and selectivity from its power-packed 5-valve chassis and 12-inch, tone-tested Rola speaker. Special features are the velvet-soft, positive tuning on the large easy-to-read dial scale, the fully variable tone control and the sliding doors on the extra-large record cupboard.

The cabinet is of traditional design in beautiful light or dark oak. Height 31½ in., width 31 in., depth 15½ in.

Fully guaranteed, La Gloria "Traditional" is a glorious performer on records or radio, and priced at **only** £49 19s. 6d., La Gloria "Traditional" is New Zealand's lowest priced, full sized, quality-built console radiogram.

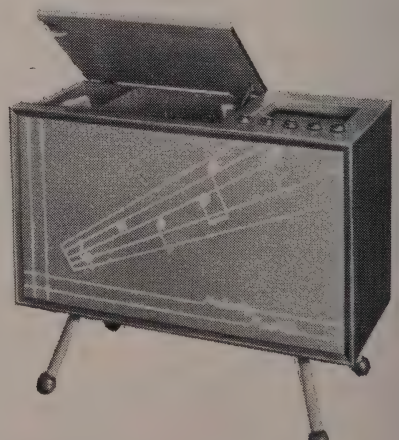
* * *

### La Gloria "MODERNE" and La Gloria "CONTEMPORARY"

With these two models La Gloria ushers in a new era of radio beauty and introduces a stimulating technique with colour. Adding new thrills to home decoration, easily changeable fabric fronts enable the radio to be tailored to match your own furnishings and drapes. Choose from beautiful imported fabrics or supply your own material for fitting.

Indeed, "Moderne" and "Contemporary" are six-valve console radiograms in which modern designing and the charm of colour express the theme for today. Blended with controlled acoustics and "living presence" tone, La Gloria gives you radio perfection from a powerful 6-valve chassis, 12-inch tone-tested Rola speaker, 2 tone controls, velvet-smooth positive tuning and large, clear dial scale and station markings.

Fitted with a high-quality English 3-speed automatic record changer which plays mixed sizes of records, La Gloria "Moderne" and "Contemporary" incorporate a conveniently placed record compartment.



The wonderful "Moderne" console radiogram comes to you in a beautiful limed oak cabinet with your

choice of changeable fabric front and top-touch tuning or armchair control. Height 28 in., width 36 in., depth 15½ in.

La Gloria "Contemporary" as illustrated (lower right on page 44) with top-touch tuning and all interior features of its sister "Moderne" is available in modern design of grey and yellow. "Contemporary" with fabric front and ball feet has been created especially for those furnishing for tomorrow. Height 28 in., width 36 in., depth 15½ in.

Fully guaranteed and backed by factory service, La Gloria offers you living tone and exotic beauty for so little—the price of these two enchanting models being **only** £54 19s. 6d. each.

La Gloria is a new, exciting range of six feature packed consoles which must be seen and heard to be fully appreciated. Write to Dominion Radio and Electrical Corporation Ltd., P.O. Box 44, Otahuhu, for distribution details and information on La Gloria's generous profit margins.

## AUTO-TIMER FOR THE G.E.C. DC114 COOKER

*Fig.* 1.—*The new G.E.C. Auto-Timer in position on a DC114 cooker.*

Automatic cooking is brought within reach of thousands by a new timer control unit which is simply fitted in place of an existing splash back to a G.E.C. DC114 Cooker. The unit incorporates an electrically operated oven timer control, a spring-wound "minute" timer and a strip lamp for illumination. Once a cooker has been fitted with this oven auto-control unit, all the housewife has to do is set the electrically-operated Auto-timer to switch on the oven at the required time, for the right period, at the desired temperature, and place the meal in the oven, which she can do up to 10 hours before the meal is required. Then, when she is out, the oven will automatically switch on at the set time, cook the meal and switch itself off. Should she be delayed for half an hour, sufficient heat is retained within the oven to keep the meal piping hot.

The ringing minute-timer which can be accurately set to give an alarm any time within the hour, is another valuable aid when cooking. If occupied with other tasks in the kitchen the user need not keep an eye on the clock when timing eggs, for example.

The Auto-Timer unit, incorporating the oven timer and ringing timer, replaces the splashguard of a DC114 cooker, and is of modern streamline design in keeping with the appearance of the cooker itself. The DC114 can be supplied complete with the timer control unit already fitted and wired ready for use, or the unit (DC140) can be supplied separately for incorporating in an existing cooker.

### OPERATION

The timer setting scales are concentric with the face of an electric clock which operates continuously as long as the external cooker control unit switch is "on". They are set by the top and bottom knobs of the three at the right of the clock face. The upper knob is turned until the "cook for" scale indicates the time required. The bottom knob is then adjusted so that the "stop at" scale shows the time when the meal is required. Finally the central knob is turned to "automatic", the oven thermostat set to the temperature required, and the meal placed in the oven.

The ringing timer at the left of the unit is a simple spring-wound mechanism which is set by the central handle and gives a loud ring when the selected time has expired.

Both dials are protected by glass, and the front is sloped back as a safeguard against their being damaged by utensils on the hob. A recessed 30W obscured Striplite lamp in the centre of the unit provides downward illumination of the hob without glare. The timer is available with a white or ivory vitreous enamel finish. Exterior metalwork is chromium-plated. Adequate ventilation at the back of the unit prevents condensation.

When the unit is added to an existing cooker, fitting is extremely simple as the fixing pins slot into the holes used for the normal splashguard. The timer is supplied complete with the necessary 4-core flexible, a terminal bracket and support bracket. Full instructions are given for fitting these brackets to the cooker and for making the simple electrical connections which should be carried out by a competent electrician.

In cookers ordered complete with the Auto-Timer the brackets are already in position and the thermostat wiring modified. The timer only needs to be placed in position and the flexible cord connected to the terminal bracket.

**Prices:** Auto-Timer D.C. 140 only, £16 4s. 6d.; Cooker D.C. 114 only, £58 12s. The price for the complete unit, that is, Cooker D.C. 114, together with Auto-Timer D.C. 140, is £74 16s. 6d.

Auto-Timers and the Model DC114 cooker are available at all branches of the British General Electric Co. Ltd., Wellington, Auckland, Christchurch, Dunedin, Hamilton, Napier, and Invercargill.

* * * *

## NEW TO NEW ZEALAND—SIMON PORTABLE TAPE RECORDER

That the new Simon Model SP/2 is made by specialists in sound recording is obvious from a study of the instrument. Every mechanical part is precision engineered. Every electronic component is of the best quality, chosen for its reliability and long service.

(Continued on page 46)

The Simon SP/2 provides superb recording and reproduction facilities in a compact and portable form.

All operations are controlled by a simple "joy-stick". A combined record/replay amplifier is incorporated which can be used as an independent P.A. Amplifier, or for record reproduction. The output power available for replay and public address purposes is 10 watts, with independent bass and treble control. A high quality 10-inch speaker is incorporated with its own gain control for monitoring of recordings. A jack is provided for headphones monitoring, or alternatively, during replay, for external loudspeaker. Tape loading is very simple. Control of the unit is straightforward. Switching is mechanically controlled.

A wide range of microphones can be supplied and Remote Control and telephone attachments are available.

A good recorder deserves a good recording tape and for the best results Simon "Simphonic" Grade A Tape is recommended.

**Brief Technical Data:**

Number of tracks: Two, side by side. Records left to right, top track oxide in.

Speeds and running times: 30 min. per track at 7½ i.p.s., 60 min. per track at 3¾ i.p.s., 45 min. and 90 min. with 8¼ reels.

Capacity: 7 in. reels carrying 1200 ft. of ¼ in. tape. 8¼ in. reels may be used if extra playing time is required.

Frequency response: At 7½ i.p.s. 50–12,000 c.p.s. ± 3 db. At 3¾ i.p.s. 50–7,000 c.p.s. + 3 db., with Simphonic Grade "A" Tape.

Mains supply: 110–120 : 200–250 volts A.C. 50 c.s.

Dimensions and weight: 18 in. x 12 in. x 12 in.; 48 lb.

The Simon Portable Tape Recorder is made by Simon Sound Service Ltd., London and distributed in New Zealand by Pye Ltd., Chancery Chambers, Auckland.

## HEATHKIT ELECTRONIC MEASURING EQUIPMENT

The Heath Company have gained astonishing success in the U.S.A. despite the great range of comparatively low cost built-up equipment available. This is due to the high-grade components used in "Heathkits" and thorough mechanical and circuit design, at surprisingly low cost.

Very complete assembly instructions, accurate metalwork and the use of printed circuits where possible, make assembly easy.

"Heathkits" can be easily assembled in odd time—for example, between servicing jobs—because the step-by-step instructions allow a stop to be made at any stage. Steps can be marked off as you go, so that it is easy to start again.

The range covers all the usual instruments—a 5 in. Oscilloscope with 5 mc. bandwith amplifier, 3 in. Oscilloscopes, VTVMs, Signal Generators, Bridges, Q Meter, Audio Generators, Audio Analyser, etc.

Forty kitsets are made in the standard range.

"Heathkits" are available from the distributors, Elekon (Overseas) Limited, 284 Queen Street, P.O. Box 5001, Auckland.

# NEW ZEALAND ELECTRONICS INSTITUTE (Inc.)

### WELLINGTON BRANCH

Commencing with March, meetings of the Wellington Branch of the N.Z.E.I. (Inc.) will be held on the first Wednesday of each month at 6 p.m. in the Conference Hall, Air Department, Bunny Street. Refreshments will be served at 5.30 p.m.

Lecturer at the well-attended February meeting was Mr. L. Morganti of EDAC, whose subject was "Transistors". Question time was lively, and members were also keenly interested in the practical demonstration of the transistor telephone amplifier developed in this country by Mr. Morganti and his associates.

At the March meeting, Mr. V. M. Stagpoole of the N.Z.B.S., chose as his subject "Overseas Reception" and illustrated his lecture with recorded examples. Long distance reception is of much interest to all members of the radio profession these days, and Mr. Stagpoole's lecture proved most popular. Stationed at the receiving site of the N.Z.B.S. at Quartz Hill (Makara) for two years, and acting officer-in-charge for the past eight months, Mr. Stagpoole was well qualified to lecture on this subject.

For the April meeting, Mr. G. W. G. Court, B.Sc., A.M.I.E.E., A.Inst.P., Superintendent Radar Engineer, Civil Aviation Administration, spoke on "Ground Control Approach Radar".

At the May meeting it is expected that Mr. Swan of the State Hydro Electric Department will lecture on communications in that Department. This lecture proved most popular at the Christchurch Branch several years ago and Wellington members look forward to an interesting evening.

In June, the Annual General Meeting and the election of officers will take place.

# N.Z.A.R.T. NOTES

(Supplied by the Publicity Committee, N.Z.A.R.T., P. O. Box 1733, Christchurch, to whom all inquiries should be addressed).

It is possible that from past notes published in these pages, many readers consider that the be-all and end-all of Amateur Radio is bound up with the numerous contests held during the year. Such, however, is not the case, as this aspect of the hobby appeals only to a small percentage of amateurs here. In general, contests come and go, attracting the same few each time. Apart from finalists, however, there are many who take only a limited part in the usual "rat-race". Admittedly, contests often provide a means for working a new country, but, alas, allow no opportunity for a decent yarn, which is small satisfaction to some. However, we make passing mention that, during recent months, the National Field Day Contest and the ARRL Contest have been held, as well as a few minor ones organized by other member societies of the IARU. In general, conditions were patchy, and, as usual, the South Island was poorly represented in the Field Day effort.

From the far north we learn that RTTY (Radio-Teletype) is on the way and that some interested amateurs have experienced the "bugs" connected therewith. As far as we know, this is the first time that such transmissions have been made in the Dominion by local amateurs. We hope that their efforts will be rewarded, and look forward to hearing more of their activities in this field.

March examinations for the Amateur Operator's Certificate of Proficiency are now over, and we look forward to seeing some of our bands more thickly populated in the near future. Certainly, they can do with it. Such is the overcrowding on the commercial spectrum that commercial interests look upon amateur bands with longing eyes, and what better opportunity for expansion than the thinly populated amateur band where space exists for the taking.

Never has the cry of "Populate or perish" been so true!

(Continued on page 52)

*For the Technician*

# Morphy Richards Auto Control Safety Electric Irons—Part 3

**Asbestos Liner (30626)**

(1) Place the clamp plate (N.Z. MR 57) in position on top of the asbestos pad and insert the nameplate between the asbestos pad and the sole plate. Position the two 20-gauge washers over the holes in the nameplate and the asbestos pad but under the clamp plate. The rear fixing screws, together with their spring washers, should now be inserted and started in their threads but not screwed up.

(2) Place the toothed washer 20182 and nut on the front stud 20324 N. Tighten the stud only and run the nut down until it touches the clamp plate. Now align the asbestos pad and clamp plate at rear centrally with the sole plate and HALF tighten the rear screws. Finally, tighten the front nut home and then similarly the rear screws.

**It is important that this order of tightening up be adhered to and that all three screws be really tight.**

**Bridge Assembly**

The bridge assembly 30619 may now be mounted on its spacing collars 31652. Note that the spindle and bush should slope slightly towards the REAR of the iron.

**Terminal Block Assembly**

(1) Next fit the terminal block assembly 35501, inserting the thin asbestos washers between it and the clamp plate. In fitting, the bi-metal pin is passed through the hole in the lower, and eyelet in the upper contact leaves, and the bead on the lower leaf is slipped under the cam face. The cam face should bear approximately half-way along the length of the insulating bead.

(2) The element should now be connected to the terminal block in the following manner:—

Left-hand connector strip to bottom central bracket.

Right-hand connector strip to right-hand upper bracket.

Lamp resistance between right-hand and left-hand brackets.

After tightening up screw, **adjust the resistance wire (30630) so that it clears all other metal parts by a good margin.**

Finally, slip over the pin the porcelain bush and run on to the pin the special brass nut (30629).

**Causes of Recurring Element Failure**

(1) **Warped Clamp Plate:** The clamp plate should always be checked for flatness by means of a straight-edge before fitting a new element. Any suggestion of warp or bend can cause a hot spot and therefore early element failure.

(2) **Pitted or Burnt Sole Plate:** Should the previous element have shorted through to the sole plate during failure and caused ridges of metal thereon, a new sole plate should be fitted before renewing the element, or if any depressions in the top surface of the sole plate are noticed, it is necessary to renew the plate. The ridges, if left, may pierce the mica of the new element, and depressions cause hot spots, both of which would mean early failure of the element. The faulty sole plate should not be ground on a stone to remove irregularities because of the danger of grinding in hollows which, as mentioned above, are a cause of element breakdown.

(3) **Badly Fitted Clamp Plate:** The correct method of fitting the clamp plate must be observed, and full instructions are given under "Asbestos Liner". Strict attention to the above will pay dividends in the reduced number of service calls.

## SECTION 10

**Setting Temperature Control**

(1) By means of control knob, set the cam to position for "wool." Place sole plate on Morphy-Richards pyrometer. Connect mains to left-hand and inside centre terminal brackets.

(2) Screw down brass nut (30629) until circuit is complete. As the temperature rises, the contacts should separate before 170° C. is reached. Readjust the nut until the thermostat cuts out at 170° C. Leave iron in circuit and check that thermostat cuts in again between 155° and 175° C. NEVER set temperature by screwing nut BACK. If you have screwed down too far, allow iron to cool, screw nut back and repeat operation, otherwise wrong temperature setting is almost certain to occur.

(3) It is important to note that the thermostat must be allowed to CLOSE the circuit after final adjustment of the nut. If the temperature is between the above limits at this moment, then the setting is correct.

(4) There is no need to check the temperature at the other parts of the knob setting since the cam will automatically look after that.

(5) Having adjusted the temperature as above, clench the parallel portion of the nut (30629) on the pin with suitable pliers and clip off any length protruding.

## SECTION 11

**Mounting Body on Chassis**

(1) If you are replacing flex, first fit rubber grommet to one end of the flex, then thread free end through hole in side of handle from INSIDE. Pull whole length of flex through until the rubber connector enters hole, and work this through until groove in rubber enters hole. (Handle, N.Z. MR 310; grommet, N.Z. MR 308).

With new-type handle and connector, pull through until flange on rubber seats against boss. (Handle, N.Z. MR 309; grommet, N.Z. MR 307.)

Old-type handles and grommets are not interchangeable with new. That is, if an old-type handle is fitted, an old-type grommet must be used, but all handles now supplied are new-type and new-type grommets must be used with them.

Attach handle to body, making sure that the asbestos washers are inserted correctly, and, in the

(Concluded on page 50)

# AROUND AND ABOUT

## PAY AS YOU SEE TV

The British Government is reported to have signed a contract with the Zenith Radio Corporation of the U.S.A. covering the use of "Phonevision"—a patented system of subscription television. The contract will cover the United Kingdom, Ireland, and the Channel Islands. "Phonevision", as developed by Zenith, is one of three devices which are at present competing for approval by the F.C.C. for public use. All three work on the principal of a device attached to the subscriber's set which scrambles the programmes to be televised, until a fee is paid.

Special programmes, such as a current West End play would then be within the reach of a larger audience in one television appearance than if it ran for months in London, and the company would suffer no financial loss through such a showing. Educational TV, barely attempted by those involved, due to cost, would be paid for by those attending classes, never moving from their living rooms, as they studied commercial law, cooking, literature, music and anything else which could be transmitted via a tube.

We might well ask if such a system is likely to find wide public support. For Britain we cannot vouch as yet, but, reading the "Cleveland Plain Dealer" we find the answer suggested as far as America is concerned. There, the Marciano-Moore fight was withheld from home television screens, but shown in 128 theatres in 92 cities from coast to coast. The revenue from this source was well over 1,000,000 dollars, whereas the gate supplied by the live audience at the Yankee Stadium was well under that figure.

Thus, it proved that, given a compelling attraction, people are willing, not to say eager to pay for the privilege of watching the telecast, and to do so under conditions considerably less comfortable than are to be found in their own homes. If 3,000 Cleveland fight fans were willing to go to the city at 10.30 p.m. and pay a stiff box office fee of three dollars fifty cents, plus a parking-lot fee, plus a restaurant or bar bill, it can be assumed that 30,000 would have paid one dollar to get the fight on their home screens—or even 300,000 would have paid twenty-five cents.

Some people have been heard to thunder their defiance, declaring that they'll never pay to see a TV programme in their own homes. That, of course, is their privilege, but the 3,000 who attended theatres in the city of Cleveland to watch the fight clearly indicated that they are willing to pay for something they want, and we suspect that in matters of this nature, the British man is not so different from his American brother.

* * * *

## GRUNDIG IN FILM THRILLER

With the release of the new British mystery-thriller "Time-slip", Grundig's TK12 tape recorder has set out on a nation-wide tour which promises to bring considerable publicity to Grundig dealers everywhere.

Recordings made on a Grundig TK12, are used in the film, and the recorder appears on the screen.

## RETURN SHOWING PARTICULARS OF CERTAIN WIRELESS APPARATUS ENTERED FOR IMPORT INTO NEW ZEALAND DURING THE SIX MONTHS ENDED 30TH JUNE, 1955

| ITEM AND COUNTRY OF ORIGIN | NUMBER | £(N.Z.) |
|---|---|---|
| **Transformers for Receiving Sets (72101.17)—** | | |
| United Kingdom | 13,963 | 1.985 |
| Australia | 8 | 42 |
| Netherlands | 660 | 214 |
| Total | 14,631 | 2,241 |
| **Valves for Receiving Sets (72104.1)—** | | |
| United Kingdom | 171,173 | 44,433 |
| Canada | 400 | 149 |
| Australia | 83,393 | 14,945 |
| Germany-Federal Republic | 4,026 | 713 |
| Italy | 1,200 | 266 |
| Netherlands | 350,006 | 68,019 |
| U.S.A. | 13,454 | 4,389 |
| Total | 623,652 | 132,914 |
| **Valves for Transmitting Sets (72104.2)—** | | |
| United Kingdom | 954 | 5,398 |
| Australia | 5 | 339 |
| Netherlands | 385 | 1,556 |
| U.S.A. | 246 | 669 |
| Total | 1,590 | 7,962 |
| **Receiving Sets, Built Up but not Mounted in Cabinets (72104.6)—** | | |
| United Kingdom | 122 | 627 |
| Netherlands | 1 | 11 |
| U.S.A. | 7 | 88 |
| Total | 130 | 726 |
| **Receiving Sets Mounted in Cabinets (72104.7)—** | | |
| United Kingdom | 649 | 7,758 |
| Canada | 2 | 18 |
| Germany—Western Zone | 2 | 25 |
| Netherlands | 2 | 15 |
| U.S.A. | 12 | 514 |
| Australia | 8 | 303 |
| Total | 675 | 8,633 |
| **Transmitting Apparatus—Other than Valves (72104.8)—** | | |
| United Kingdom | | 10,404 |
| Australia | | 1,377 |
| Denmark | | 109 |
| Germany—Federal Republic | | 71 |
| Netherlands | | 1,899 |
| Total | | 13,860 |
| **Other Wireless Apparatus (72104.13)—** | | |
| United Kingdom | | 152,173 |
| Australia | | 31,324 |
| Denmark | | 348 |
| France | | 1,651 |
| Germany—Western Zone | | 4.285 |
| Italy | | 183 |
| Netherlands | | 23,400 |
| Sweden | | 2,554 |
| Japan | | 140 |
| U.S.A. | | 1,943 |
| Total | | 218,001 |

The values shown above represent the current domestic values in the countries of export expressed in terms of New Zealand currency.

When there's a better switch
ARCOLECTRIC will make it
New Zealand Agents
GREEN & COOPER LTD. WELLINGTON.

# "Radio New Zealand" Frequencies

From Friday, 20th January, 1956 (N.Z. Date), Radio New Zealand will transmit in accordance with the following frequency schedule:—

1. TO AUSTRALIA:

| | | | |
|---|---|---|---|
| 2000-0615 | GMT | ZL10 | 15.22 Mc/s in the 19 metre band. |
| 0630-close | down | ZL2 | 9.54 Mc/s in the 31 metre band. |

2. TO PACIFIC ISLANDS

| | | | |
|---|---|---|---|
| 1700-2155 | GMT | ZL3 | 11.78 Mc/s in the 25 metre band. |
| 2210-0245 | GMT | ZL4 | 15.28 Mc/s in the 19 metre band. |
| 0300-0615 | GMT | ZL3 | 11.78 Mc/s in the 25 metre band. |
| 0630-close | down | ZL7 | 6.08 Mc/s in the 49 metre band. |

Close Down is at: 1045 GMT. on weekdays;
1120 GMT on Saturdays;
1000 GMT on Sundays.

News Bulletins may be heard at—
1800 hours GMT (London News)
1900 hours GMT (London News)
2000 hours GMT (London News)
0033 hours GMT (N.Z. News) Mon. to Fri. incl.
0630 hours GMT (London News)
0830 hours GMT (N.Z. News) Mon. to Sat. incl.
1030 hours GMT (N.Z. News) Mon. to Sat. incl.

# Missing and Stolen Radios

**Auckland:**
Pacific 6-valve, battery/electric portable radio, serial No. 6P 143173; blue metal cabinet 18 in. x 12 in. x 7 in., with black knob on top under black plastic ribbed handle; two knobs on front; two chrome metal strips across front.

**Tokaanu:**
Pacific 5-valve battery/electric portable, serial No. GN 23751; light blue plastic cabinet with white facings; fitted with white two-ply plastic cord with three-pin double connection on end. Excellent condition.

**Taihape:**
Autocrat 6-volt battery portable, serial No. either 18669 or 18571; battleship-grey steel cabinet 10 in. x 4 in. with plastic dial covering Australian and New Zealand stations; chrome bucket type handle.

**Wellington:**
A.W.A. 6-valve battery/electric portable, model 653, serial No. 55143; ivory cabinet.

**Christchurch:**
Bell 5-valve mantel radio, serial No. 20446; red plastic cabinet.

**Westport:**
Courier 7-valve broadcast radio chassis, R.O. model.

RADIO RECOVERED.

Dunedin: Mullard model 520 table radiogram, serial No. 29557.


**RADIO SERVICING**

*Correspondence Course specially compiled to meet New Zealand Examination Syllabus. Free prospectus.*

**NEW ZEALAND RADIO COLLEGE**
26 HELLABY'S BUILDING - - - AUCKLAND, C.1

DO YOU LIVE IN WELLINGTON?
IF SO, CALL ON

**CAMBRIDGE RADIO AND ELECTRICAL SUPPLIES**
38 Cambridge Terrace,
P.O. Box 6306, Wellington. Tel. 51-209
FOR YOUR REGULAR REQUIREMENTS

TREATS FOR THE CHILDREN!

**HOLIDAY TRAINS AGAIN!**

Yes, the May school holidays (May 5 to May 20) are in the offing . . . . .

Trips by train or railcar offer wonderful opportunities, for young and old alike, for travel enjoyment at low cost. With or without the children, you'll appreciate the spacious comfort and the amenities of rail travel.

Sleek new diesel railcars and fast express trains offer better services this year than ever. Seats will be in heavy demand. There will be many extra services, but it's not too soon to reserve right now!

**Ride by Rail and RELAX!**

NEW ZEALAND RAILWAYS

# For the Technician

(Continued from page 47)

case of metal bodies, type N.Z. MR 301, the oval porcelain bushes now fitted to the terminal slots.

With metal body, ensure that asbestos heel pad is in position under heel of handle.

(2) Place the body on the chassis so that the control spindle and bush pass through the clamping hole, and the terminal brackets through the slots at the rear.

(3) Run on the front brass nut (30611), align the body and sole plate, and tighten up the nut firmly with the spanner provided.

(4) Connect the red flex lead to centre inner bracket and the black lead to the left-hand terminal bracket. Clear the leads from the brackets so that lamp cover contacts can touch the outer brackets without fouling any of the wiring. The lamp cover and knob can now be attached. Note that the grub-screw on the control knob seats on the "flat" on the control spindle, and its rim just clears the body.

(5) Insert the rear fixing screw (20137 N), threading it in order through eyelet of the earth lead and bracket (30608 N). Work the end of the screw into its threaded hole in the clamp plate and screw down sufficiently firmly to hold the bracket, but using no excess force.

**Final Test**

(1) Check continuity with the iron cold at all knob positions.

(2) Test for insulation between mains and earth leads.

(3) Clean up iron for dispatch.

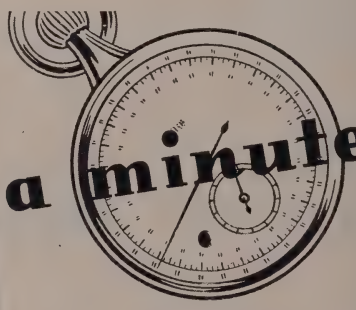

**CLASSIFIED ADVERTISEMENTS**

**FOR SALE:** Five ZC1 Mark 1 transmitter Receivers, four complete with all equipment as purchased War Assets, one incomplete. Available separately or as bulk purchase. Apply: Stores Manager, Rural Aviation Ltd., New Plymouth, or ring 21-002.

**FOR SALE:** One new A.W.A. Radio Receiver, Type 1C55163, 7-valve, 5-band range, 230-volt electric, steel case, baked enamel; 190 kc/s. to 510 kc/s, and 550 kc/s to 32 Mc/s. £85 cash. Write: E. JARVIS, Main Road, Stokes Valley.

**BACK NUMBERS OF "R. & E."**
Available from our Office,

B.B.




To the left, you will see the products of a minute . . . a variety of machine parts, each essentially different. Any one of these parts can be produced in terms of minutes. At the top, each unit is produced by ONE lathe at the rate of 2 per minute, in the centre at 4 per minute, at the bottom at 8 per minute. AUTO MACHINES have MANY automatic lathes, and the combination of speed with absolute accuracy is the basic reason why AUTO MACHINES produce component parts faster, better, and more economically priced.

**AUTO MACHINE**
MANUFACTURING CO. LTD.
18-20 NELSON ST., AUCKLAND
C.P.O. Box 179 Phone 31-638

# Radio Industry to Have "New Look"

(Continued from page 29)

Personnel technically trained for TV are already available, well in advance.

"Although Philips are prepared for whatever standard is chosen, we do feel that with almost the whole world standardizing on the CCIR system (625 lines) then New Zealand should do the same, as Australia has already done.

"The beginnings of TV in New Zealand will be a challenging period for retailers. It will be essential for them to equip themselves effectively with accurate and reliable testing and measuring instruments because no matter how good a serviceman may be he cannot effectively service a TV set without a comprehensive range of equipment. A successful TV retailer will therefore have to accept the fact that he will spend somewhere between £300 and £400 on equipment alone.

"Knowing the problems in other countries, Philips New Zealand will be to the forefront in helping technicians with their problems of installation and maintenance by supplying reliable technical information and assistance, dependable measuring instruments, and by helping to train them to cope efficiently with television work."

Mr. Lord concluded: "The research and manufacture at Naenae will enable us to give this help in the direction it is most needed—in dealing with the local technical specialization of bringing TV over the New Zealand topography to give best results in the New Zealand home."


## "MAKE-IT-YOURSELF"

## A low voltage

THREE-HEAT

## ELECTRIC BLANKET

"Teleco" has produced this season's best seller —a most attractive combination bedside lamp and electric blanket unit. The low voltage transformer is built into the base of the lamp completely wired ready for use. The lamp and blanket, being separately switched, can be used independently.

All you do is sew the heater wire, which is provided, on to a cloth, and YOU CAN SAVE POUNDS!

£8 17s. 6d. ..... Single Blanket
£9 17s. 6d. ..... Double Blanket

Write for full details and order NOW!
Trade inquiries invited

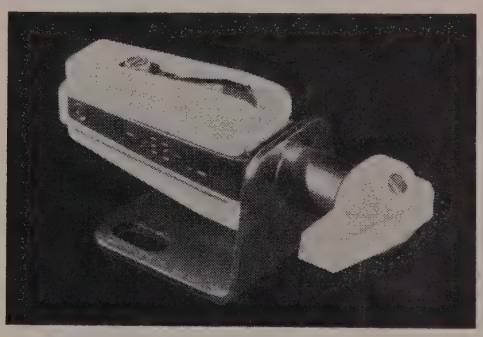
**TELECOMMUNICATIONS LTD.**
27 TORY STREET — WELLINGTON

# RONETTE

## HIGH FIDELITY

## CARTRIDGE

## TYPE T.O 284 P.X.



This cartridge has been developed especially for reproducing records which have been recorded with the *New Orthophonic System.* Flat response: 20–1700 cycles. Stylus pressure 2–6 gms. Load on L.P.: 500K. Load on 78: 120K.

**GREEN and COOPER LTD.**
43 LOWER TARANAKI ST. - PHONE 56-031

### BRITISH RADIO SHOWS IN 1956

The 23rd annual (British) National Radio Show will be held at Earls Court, London, from Wednesday, August 22, to Saturday, September 1, 1956, with a pre-view for overseas visitors and other special guests on Tuesday, August 21.

The exhibition, as previously, will be primarily concerned with broadcasting and all the equipment for it. It will include demonstrations of the latest television techniques, from every stage from camera to screen. There will also be exhibits of components and valves, electronic equipment for industry, Service equipment and training methods.

Organizers are the Radio Industry Council, 59 Russell Square, London, WC.1.

## N.Z.A.R.T. NOTES

(Continued from page 46)

There have been many complaints of the occupation of amateur bands by commercial stations, and this Association is doing everything possible to correct the situation. In this we are receiving the utmost co-operation from the Post and Telegraph Department, as a result of which many offenders have been moved. In this matter, every amateur and every listener equipped with a reasonably accurate frequency meter can help by noting the frequency and time of any commercial transmission heard in an exclusive amateur frequency allocation. Reports of same should be sent to ZL2IY, Mr. W. D. Gorman, c/o P.O. Box 489, Wellington. As a note of warning, however, we ask that you ensure that the transmission heard is not an image from a commercial operating at twice the intermediate frequency of your receiver away from the frequency shown on the meter.

### PHILIPS NEW UNIVERSAL FILM PROJECTOR

The "Todd-OA" filming system recently introduced in New York is characterized by the use of a wide and highly curved projection screen. Both this screen and the stereophonic sound should convey to the spectators the impression that they are actually taking part in the action on the white screen. At first sight this system resembles Cinerama. The latter system, however necessitates the use of three projectors operating at the same time, whereas in the Todd-OA system developed by the American Optical Company, one projector is sufficient—which naturally is a simpler and better solution.

In the Todd-OA system, the film strip has a width of 70 m.m., instead of the usual 35. For this reason special projectors had to be developed. Philips, when required to do this, succeeded in constructing a projector which can be used for both the 70 and the ordinary 35 m.m. films. This is not at all a simple task if it is considered that the 70 m.m. films are projected with a speed of 30 frames a second, whereas the 35 m.m. films have a speed of 24 frames per second only.

The fact that it will also project Cinemascope films as well as 3-D films and "wide-screen" films of various types is sufficient proof that this is an all-round projector. Finally, these projectors are also suitable for scanning both photographic and magnetic sound tracks.

* * * *

### TEACHERS SEE RCA DISPLAYS IN INDIA

Teachers from Bombay and the surrounding country were invited to visit displays of RCA 400 16 mm. Magnetic Recorder-Projector and various models of the RCA Magnetic Tape Recorder.

The exhibition reviewed for teachers the important role RCA equipment plays in education in India, a nation which has a highly organized audio-visual system. Teachers were enthusiastic in reception of this demonstration, which was very well attended.


Modern Business needs . . .

modernphones

EXECUTIVE INTERCOM

SINGLE-LINE MODERN MINOR

FIVE-LINE MODERN MINOR MODEL AVAILABLE UP TO 30 LINES

You press a button and get your man. Delays are reduced—Time is saved . . . with Modernphone comes increased efficiency.

Immediate connection to the desired extensions.

Simultaneous confidential conversations.

Telephone conference—with ease.

Full intercommunications.

Desk or wall mounting models available.

Battery-operated or battery eliminator if desired.

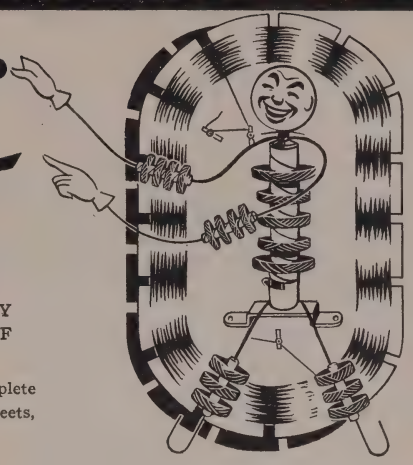
Write for further information to the Distributors:

ULTIMATE EKCO (N.Z.) CO. LTD.

6-14 QUAY STREET, AUCKLAND. PHONE 30-195 (4 lines)

(Formerly known as RADIO (1936) LTD.)

SPECIALISTS IN A
Inductances
HIGH FREQUENCY
SPECIALIZED FIELD.



WRITE FOR FREE COPY
OF LATEST CATALOGUE OF
PREFERRED TYPES.

(A specially prepared folder, complete with catalogue and technical data sheets, available for 2s. per copy).

*Inductance Specialists.*

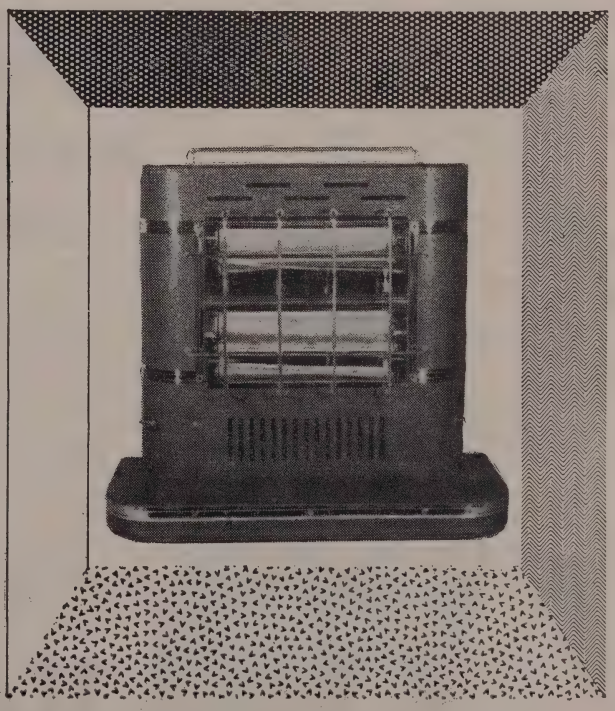
The New Zealand High Frequency Specialists,
157 Thorndon Quay, Wellington, New Zealand

COILS, I.F. TRANSFORMERS, H.F. CHOKES, B.F.O.'s DIALS, SCALES, COIL ASSEMBLIES, GANGS, BUILT-UP UNITS, ETC.

EDINBURGH
*Electric Radiator*

ANOTHER PANAMA PRODUCT

★ Two 10-inch bars
★ Individual Switching
★ Red Glow Visible at Base
★ Louvres for Heat Dissipation
★ Crackle Finish
★ Chromium Trimmings
★ Easily Portable



*Available from*

**CORY-WRIGHT and SALMON LTD.**

AUCKLAND WELLINGTON
CHRISTCHURCH DUNEDIN

# Record Talk

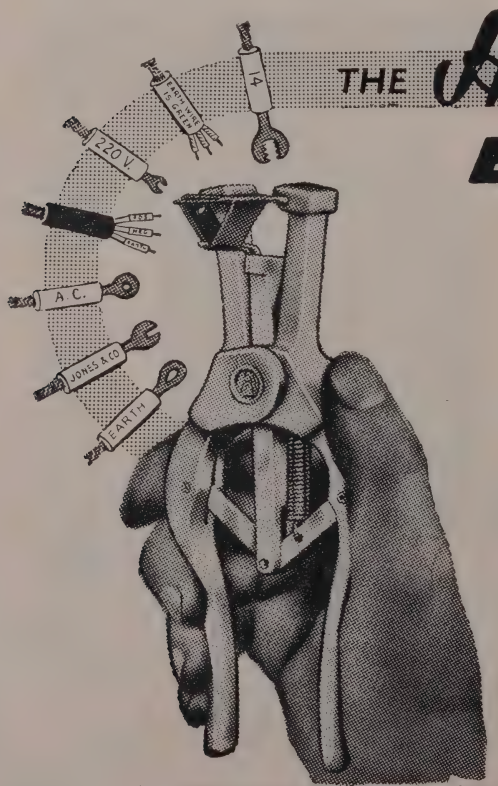
(Continued from page 37)

which has been grafted the complete Mendelssohn music, as played by the B.B.C. Symphony Orchestra under Sir Malcolm Sargent. This conductor is also in charge of H.M.V.'s two-disc version of "The Beggar's Opera" (CLP1052-3) which, like the Argo set, employs a double cast of singers and actors. The Australian baritone John Cameron is featured in the singing role of Captain MacHeath. The spirit of Chaliapin seems to hover above H.M.V. ALP1266, "Russian Folk Songs and Sacred Music", which gives a dozen numbers, alternatively devotional and rousing, sung by Boris Christoff with the Feodor Potorjinski Russian Choir. These range from swaggering songs with balalaika accompaniment to devout church pieces by such composers as Gretchaninoff.

A curious feature of the international musical scene is the number of star conductors whose surnames begin with K. They crop up like mushrooms all over the record lists, and one of the greatest of them is possibly the oldest, the famous German-Jewish musician Otto Klemperer. It is good to have this veteran invited to record with the Philharmonia Orchestra, and two superb discs have just appeared: 33CX1241 which couples the well known Brahms-Haydn Variations with Hindemith's ballet "Noblissima Visione", and 33CX1257 on which Mozart's "Jupiter" symphony is paired with the entrancing early one in A major. But the most famous of the Ks is undoubtedly Columbia's ace conductor, Karajan. He enters the Mozart bicentenary stakes with our first LP release of "Cosi fan Tutte", one of the best sets ever made of a Mozart opera (33CX1262-4). With Elisabeth Schwarzkopf in the lead, this one takes on the air of a gala performance. There is Nan Merriman's mezzo as a beautiful foil, and the men are Leopold Simoneau, Rolando Panerai and Sesto Bruscantini. A better line-up for "Cosi" could scarcely be imagined, and with the Philharmonia in support we have all we need desire. Karajan and this orchestra have also given us the Beethoven "Fifth" (33CX1266) and, as in the case of the fourth released the other month, the disc is rounded off by a vocal bonus as Schwarzkopf sings a Beethoven aria, this time it is Leonora's great scene from "Fidelio".

The general thaw in East-West relations is reflected in recent news from the studios. Columbia have recently made some performances by the Soviet stars David Oistrakh and Emil Gilels, and took advantage of Khachaturian's recent visit to England to have him record a suite from his popular and tuneful ballet "Gayaneh" in which he conducts the Philharmonia on 33C1041. They have even found a chamber ensemble, the Armenian State String Quartet, who play Schubert's "Death and the Maiden" quartet on 33CX1284. Decca, on the other hand, have reversed the process. The mountain has gone to Mahomet, and this company sent a team of recording engineers to Yugoslavia last year. They returned with several highly interesting performances. LXT5049-53 contains an absolutely complete presentation of Borodin's great opera "Prince Igor", recorded by the National Opera of Belgrade. Isolated parts of this epic work have been well known for many years, but it is a moving experience to listen to the entire work, and the performance under Oscar Danon is good enough for anyone interested in this lengthy and rewarding score. An even rarer event is the appearance of Moussorgsky's "Khovantchina", likewise rendered complete on LXT5045-8, while I hear that "Boris Godounov" and "Eugen Onegin" are due from the same source.

All these are admittedly discs for those with specialized interests. The less adventurous, however, are equally well catered for. I have been delighted with a new release of that old charmer, the "Ballet Suite No. 1", arranged from Gluck's operas by Felix Mottl. The undying tunes from "Orpheus", "Armide" and "Iphigenia in Aulis" are well played by the New Symphony Orchestra under Robert Irving, and on the reverse we find an equally enjoyable suite by the composer Gretry, as arranged by Constant Lambert (LXT5063). Julius Katchen is in fine form with Gershwin's Concerto in F major and the Rhapsody in Blue, both on LXT5059. The accompaniment is by Mantovani, and, despite the emergence, at one or two points, of that peculiar violin tone which has made him a best seller in the field of popular trifles, the disc is a rewarding one on the whole. Grieg's Peer Gynt Suite No. 1 has been coupled with his likeable Norwegian Dances on Parlophone PMD1025, and these are in the safe hands of Fistoulari and the Philharmonia Orchestra. The sparkling Rossini-Britten suites "Soirees Musicales" and "Matinees Musicales" make a good coupling, and their appearance is welcome on London International, W91075. The New Symphony Orchestra is here under the direction of Edgar Cree.


THE Hellermann SYSTEM

BINDS, INSULATES AND MARKS

in one simple operation

This illustration shows just how quickly cables can be bound, insulated, and marked, by fitting Hellermann plastic sleeves under tension.

With the Hellermann system you reinforce the cable, exclude moisture and identify by colour or mark. Such time-saving efficiency pays for itself in man-hours saved.

For fullest details write New Zealand Agents:

HAMER

ELECTRICAL CO. LIMITED

P.O. Box 798, CHRISTCHURCH. P.O. Box 1024 DUNEDIN

H.40.

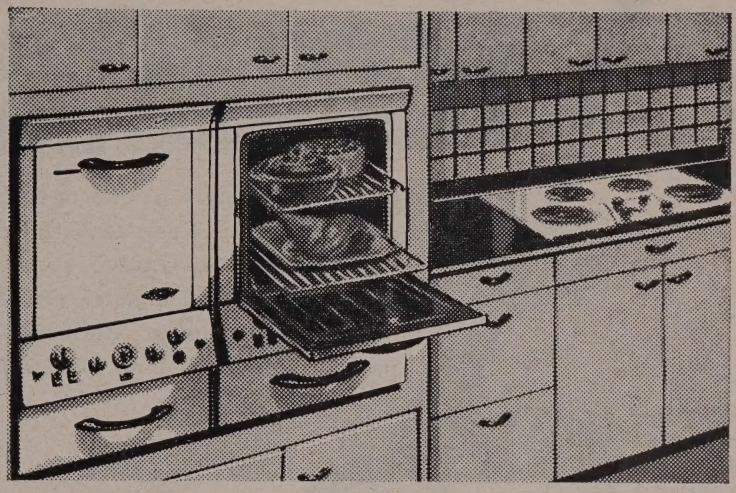
# *Here it is* - EYE-LEVEL COOKING a great new idea from NEECO

*NEECO*

*Ensemble*

There's no limit to the ways you can fit this amazingly versatile combination into your kitchen plan. Comprises fully automatic single or dual ovens, with pre-set timer.

Four-plate separate cooking top (hi-speed radiant elements) can be aligned with sink, refrigerator or work bench. A modern, functional arrangement for preparing and serving meals.



**THE NATIONAL ELECTRICAL AND ENGINEERING CO. LTD.**

AUCKLAND - WELLINGTON - CHRISTCHURCH - DUNEDIN - HAMILTON - WANGANUI
HASTINGS - INVERCARGILL

*to protect your family and home*

- Close mesh safety guard covers reflector. Prevents clothing or children touching red hot elements.
- Safety guard also prevents elements falling on to floor if broken.
- Safety stops prevent adjustable reflector throwing heat down on floor. Fire risk eliminated.
- Porcelain insulators, prevent short-circuits between element standards and reflector if radiator dropped.
- Safe to move when in use. Handle well away from heat.

AS ILLUSTRATED

D.52 Double Element **£4-19-6**

D.41 Single Element **£3-19-6**

Reflectors are chromed on BRASS for long life.

Poweray ELECTRICAL APPLIANCES

**THE *SUPER-SAFE* ELECTRIC RADIATORS**

See your Electrical Retailer Now

New Zealand Agents: C. & A. ODLIN TIMBER & HARWARE CO. LTD., Wellington

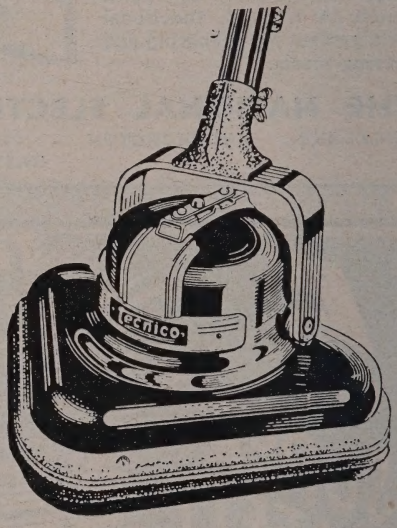
*FOR EFFICIENCY*

*plus RELIABILTY . . .*

**Tecnico ELECTRIC LAWN MOWERS**

Trims and mows in one operation . . . is light, sturdy and easily handled. Easy adjustment lever gives choice of three cutting heights. Unique scything action of 10,000 cutting actions a minute enables the TECHNICO lawn mower to deal with the most stubborn grass. Bearings are grease-packed and sealed—no lubrication required for years.

No interference to your radio—or your neighbours' —thanks to suppressor in all TECHNICO appliances



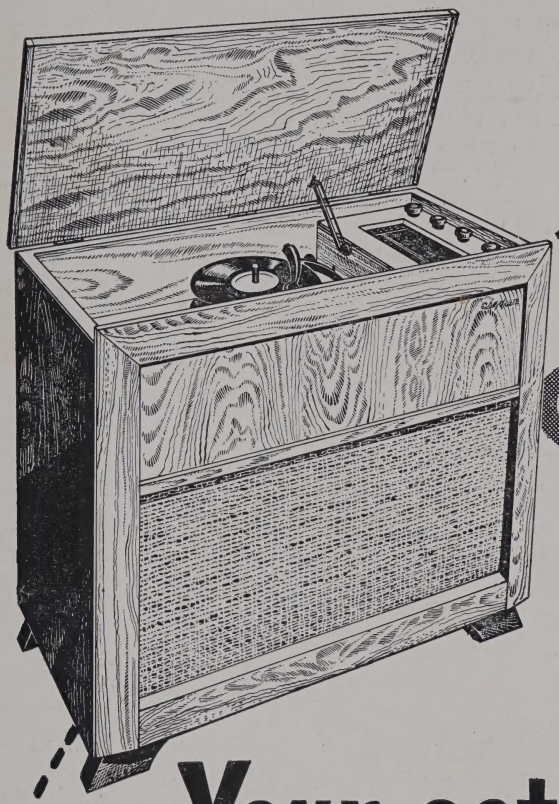

**Tecnico POLISHER SCRUBBERS**

The 3-brush TECHNICO is the perfect electric polisher scrubber for households, shops, offices, hotels, etc. Triangular head provides easy access to corners. Recommended for wood, tiles, lino, terrazzo, rubber, and smooth cement floors . . . for a finish that rivals a palace.

*Sole New Zealand Distributors:*

# H. W. CLARKE (N.Z.) LTD.

AUCKLAND - WELLINGTON - CHRISTCHURCH - DUNEDIN



Clipper

MODEL 966

£68/19/6

# Your set for life

You are really "set for life" when the Clipper 966 comes to grace your home. Housed in a beautifully styled oak cabinet (light or dark) the 966 features a 12" loudspeaker and a **special Radiogram switch** for extra fidelity. See your local dealer today.

*Available at Radio Dealers Everywhere*

Clipper

*The Choice of a lifetime*

6 VALVE BROADCAST
AUTO-CHANGE
RADIOGRAM

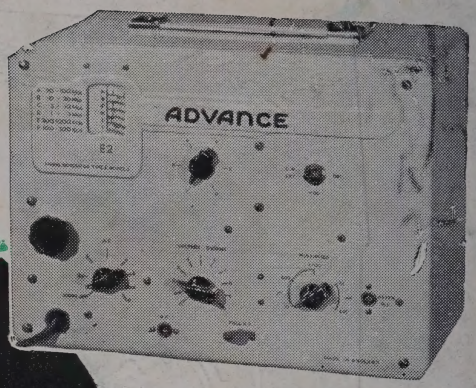
**Sole New Zealand Distributors:**
**G. A. WOOLLER & CO. LTD.,**
**Head Office Box 2167, Auckland.**

C25.24

AUDIO FREQUENCY SIGNAL GENERATOR FOR TELEPHONE AND COMMUNICATIONS SERVICING

Frequency Range 15 c/s to 50,000 c/s in three bands.

Frequency Accuracy: ± 2% ± 1 c/s.




# "Advance" SIGNAL GENERATORS

RADIO FREQUENCY SIGNAL GENERATOR

Frequency Range: 100 Kc/s to 100 Mc/s in six bands.

Calibration Accuracy: ± 1%.

AUDIO FREQUENCY SIGNAL GENERATOR FOR THE AUDIO ENGINEER

Frequency Range 15 c/s to 50,000 c/s in three bands.

Frequency Accuracy: ± 1% ± 1 c/s.

## New Attractive Price Range

*We wish to announce our appointment as sole New Zealand Agents for "ADVANCE" Signal Generators, now available at a new attractive price range. In addition, "ADVANCE" manufactures constant voltage transformers in a range of 10 watts to 6 K/W; 11 types available in either standard or tropical finish. Also, "VOLSTAT" adjustable voltage stabilizers, "ADVOLT" automatic voltage boosters, and KI magnetizers.*

*Illustrated folders, giving full technical details, are available on request.*

SERVICE OSCILLATOR

Frequency Range: 100 Kc/s to 100 Mc/s in six bands.

Calibration Accuracy: ±1%.

AVAILABLE ONLY FROM N.Z. AGENTS:

**TURNBULL & JONES LTD.**

AUCKLAND · WELLINGTON · CHRISTCHURCH · DUNEDIN
HAMILTON · PALMERSTON NORTH
NELSON AND INVERCARGILL